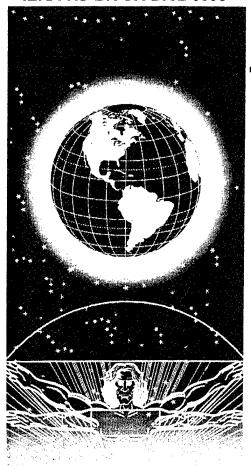
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Aircraft Engine and Auxiliary Power Unit Emissions Testing: Final Report Addendum F119-PW-100 Engine Emissions Testing Report

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TABLE OF CONTENTS

<u>Section</u>			<u>Page</u>
Preface			ii
Appendices Figures Tables			v vi vii
Executive S	umma	ry	1 of 8
1.0	Intro	duction	1 of 5
	1.1	Previous Studies	1 of 5
	1.2	Background	2 of 5
	1.3		4 of 5
	1.4		5 of 5
		1.4.1 F119-PW-100	5 of 5
		1.4.2 Test Facility	5 of 5
2.0	Facili 2.1	ity and Sampling Apparatus Description Lockheed Martin Aeronautical Systems (LMAS)	1 of 17
		Test Facility Overview	1 of 17
	2.2	Engine Exhaust Sampling Rake System	2 of 17
	2.3	Augmentor Tube Slipstream Sampling System	2 of 17
3.0	Samp	oling Procedures and Methods	1 of 22
	3.1	General Sampling Considerations/Complications	1 of 22
		3.1.1 Pollutant Distribution in the Augmentor Tube	2 of 22
	3.2	Emission Testing	4 of 22
		3.2.1 Flow Rate Measurement	6 of 22
		3.2.2 Pretest Measurements	7 of 22
		3.2.3 Emissions Test Methods	8 of 22
		3.2.4 Ambient Air Sampling	11 of 22
		3.2.4.1 Particulates	12 of 22
		3.2.4.2 Volatile Organic Compounds	12 of 22
	0.0	3.2.4.3 Carbon Monoxide and Nitrogen Oxides	13 of 22
	3.3	Engine Test Cycle Data	15 of 22
	3.4	JP-8 Fuel Sampling and Analysis	15 of 22
	3.5	Engine Testing Matrix	16 of 22
		3.5.1 Engine Shakedown Runs	16 of 22
		3.5.2 Engine Testing	16 of 22
		3.5.3 Engine Emission Trend Development	10 of 22

TABLE OF CONTENTS (continued)

	3.6	Emission Test Schedule	18 of 22
	•	3.6.1 Personnel Responsibilities	21 of 22
4.0	Calc	ulation of Airflow	1 of 12
	4.1	Calculation of Exhaust Airflow using Tracer Gas	1 of 12
		4.1.1 Tracer Gas Methodology	1 of 12
	٠	4.1.2 Sampling for SF ₆ and Determining a Homogeneous	
		Exhaust Mixture	4 of 12
		4.1.3 Determination of Average SF ₆ Concentration	4 of 12
•		4.1.4 Evaluation of Average SF ₆ Concentration	5 of 12
		4.1.5 Use of SF ₆ Concentration to Adjust Other Sample	•
		Results	5 of 12
	4.2	Calculate of Inlet and Outlet Airflow Using a Carbon	
		Balance	5 of 12
	4.3	Calculation of Airflow Using F-Factor	9 of 12
5.0	Qual	ity Assurance Procedures	1 of 20
	5.1	Quality Control Procedures	1 of 20
		5.1.1 Field QC Sample Collection/Preparation	
		Procedure	1 of 20
		5.1.1.1 QC Procedures for Stack Gas Sample	
		Collection	3 of 20
		5.1.1.2 Velocity/Volumetric Flow Rate QC	
		Procedures	3 of 20
		5.1.1.3 Moisture Content and Sample Volume	
		QC Procedures	4 of 20
		5.1.2 Exhaust Gas Blank Sample	5 of 20
	5.2	Sampling Containers, Preservatives, and Volume	
		Requirements	6 of 20
	5.3	Decontamination Procedures	6 of 20
	5.4	Sampling Packaging and Shipment	8 of 20
	5.5	Custody Procedures	9 of 20
		5.5.1 Field Custody Procedures	9 of 20
	5.6	Calibration Procedures and Frequency	13 of 20
		5.6.1 Field Instrument Calibration	13 of 20
	5.7	Data Reduction, Validation, and Reporting	13 of 20
		5.7.1 Data Reduction	14 of 20
•		5.7.1.1 Field Data Reduction Procedures	14 of 20
		5.7.1.2 Office Calculations	14 of 20
		5.7.2 Analytical Data Validation Evaluation	17 of 20
		5.7.2.1 Procedures Used to Evaluate Field Data	17 of 20
		5.7.3 Data Reporting	18 of 20
		5 7 3 1 Field Data Reporting	18 of 20

TABLE OF CONTENTS (continued)

	5.8	Preventative Maintenance Review	18 of 20
	•	5.8.1 Field Instrument Preventative Maintenance	18 of 20
	5.9	Corrective Action	19 of 20
6.0	Resu	ılts	1 of 36
	6.1	Gaseous Pollutants	2 of 36
		6.1.1 Shakedown Runs	2 of 36
		6.1.2 Gaseous Emission Factors	4 of 36
	6.2	Volatile Organic Compounds	5 of 36
		6.2.1 Speciated Pollutant Comparison	6 of 36
	6.3	Aldehyde and Ketones	6 of 36
	6.4	Pollutant Mixing in the Augmentor Tube	7 of 36
	6.5	Particulate Matter	8 of 36
		6.5.1 Particle Characterization	11 of 36
	6.6	Exhaust Flow Determination	12 of 36
	6.7	Fuel Analysis	12 of 36
-	6.8	Engine Operation	12 of 36

APPENDICES

- A Raw Field Data
 - B Particulate Analytical Results

FIGURES

Number		<u>Page</u>
2-1	Overview of Hush House Physical Layout	6 of 17
2-2	Overview of Hush House Layout	7 of 17
2-3	Engine Mounted for Testing in Hush House	8 of 17
2-4	Exhaust Deflector Plate	9 of 17
2-5	Rake Assembly	10 of 17
2-6	Engine Sampling Rake	11 of 17
2-7	Augmentor Tube Side-Stream Sampling System (Elevation View)	12 of 17
2-8	Augmentor Tube Side-Stream Sampling System (Plan View)	13 of 17
2-9	Augmentor Tube Sampling Rake (View from Test Engine)	14 of 17
2-10	Orthogonal View of Slip-Stream Sampling Apparatus	15 of 17
2-11	Augmentor Tube Side-Stream Extraction Tube and Gas Sampling	16 of 17
2-12	Augmentor Tube Side-Stream Sampling System Duct	17 of 17
3-1	Time-Line for F119-PW-100 Engine Testing at the Lockheed Martin Aeronautical Systems	20 of 22
6-1	Augmentor Tube Sampling Rake (View from Test Engine)	13 of 36

TABLES

Number		<u>Page</u>
III-1	Criteria Pollutant Summary	7 of 8
III-2	Air Pollutant Summary	8 of 8
1-1	U.S. Military Specifications of Turbine Fuels, JP-8 USAF MIL-T-83133A-AMD.1; 4 April 1980; Kerosene or JP-8	3 of 5
3-1	Summary of Source Target Compounds for Volatile Organic Compounds	9 of 22
3-2	Summary of Source Target Metals from JP-8 Fuel Analysis	11 of 22
3-3	Summary of Ambient Target Compounds for Volatile Organic Compounds	14 of 22
3-4	JP-8 Fuel Analysis Requirements	16 of 22
3-5 .	Engine Emission Sampling Matrix	19 of 22
3-6	Example Breakout of Field Team Personnel and Responsibilities	22 of 22
5-1	Summary of Analytical QA/QC Samples	2 of 20
5-2	Recommended Sample Containers, Preservation Techniques, and Holding Times	7 of 20
5-3	Legend for Sample Identification System	12 of 20
5-4	Activity Matrix for Calibration of Equipment	15 of 20
6-1	Gaseous Emissions Summary – 10% Power Setting	14 of 36
6-2	Gaseous Emissions Summary – 20% Power Setting	15 of 36
6-3	Gaseous Emission Summary – 70% Power Setting	16 of 36
6-4	Gaseous Emission Summary – 100% Power Setting	17 of 36
6-5	Gaseous Emission Summary – 150% Power Setting	18 of 36

TABLES (continued)

6-6	Gaseous Emissions Summary – Various Power Settings Slipstream Rake	19 of 36
6-7	Slipstream Rake - Emission Factor Summary	20 of 36
6-8	Engine Rake Emissions Factory Summary	21 of 36
6-9	Emissions Factor Summary – Volatile Organic Compound (VOCs) – Idle	22 of 36
6-10	Emissions Factor Summary – Volatile Organic Compound (VOCs) – Approach	23 of 36
6-11	Emissions Factor Summary – Volatile Organic Compound (VOCs) – Intermediate	24 of 36
6-12 -	Emissions Factor Summary – Volatile Organic Compound (VOCs) – Military	25 of 36
6-13	Emissions Factor Summary – Slipstream Duct (Aldehyde/Ketones)	26 of 36
6-14	Emissions Factor Summary – Engine Rake – Benzene	27 of 36
6-15	Emissions Factor Summary – Engine Rake – Aldehyde/Ketones	28 of 36
6-16	Slipstream Rake Intake – Sample Point Data Comparison	29 of 36
6-17	Emissions Factor Summary – Particulates – Idle	30 of 36
6-18	Emissions Factor Summary – Particulates – Approach	31 of 36
6-19	Emissions Factor Summary – Particulates – Intermediate	32 of 36
6-20	Emissions Factor Summary – Particulates – Military	33 of 36
6-21	Particle Size Distribution	34 of 36
6-22	Fuel Metals Analysis	35 of 36
6-23	Engine Operation Summary	36 of 36

Test Report
Executive Summary
Revision 1
June 2002
Page 1 of 8

EXECUTIVE SUMMARY

I.0 INTRODUCTION

The U.S. Air Force is developing a new fighter bomber designated as the F-22, Raptor. The aircraft will be equipped with two F119-PW-100 augmented turbofan engines. To evaluate the potential impacts of this aircraft on ambient air quality, AFIERA/RSEQ with the assistance of the F-22 Systems Program Office characterized emissions from the F119-PW-100 engine. The emission tests were conducted at the Lockheed Martin Marietta, Georgia, facility in a government-owned hush house. During the emission test, Pratt & Whitney operated the engine.

The results from this test and other emission test programs will be used to evaluate potential environmental impacts that may be created by the bed down of the aircraft at various Air Force Bases.

I.1 Objectives

The purpose of this engine emissions testing program was to develop emission factors for the F119-PW-100 engine under representative engine load conditions. All testing was performed by the Environmental Quality Management Inc. (EQ) and Roy F. Weston, Inc. (Weston) team. Testing was conducted for criteria pollutants and select hazardous air pollutants (HAPs), e.g., aldehyde/ketones and volatile organic compounds.

II. 0 SAMPLING METHODOLOGY

Sampling was performed for criteria pollutants and those HAPs that are products of incomplete combustion (PICs). Environmental Protection Agency (EPA) emissions test methods (Title 40, Code of Federal Regulations, Part 60, Appendix A) were followed during this test program. The test methods were modified where necessary due to the unique circumstances encountered during the program: i.e., high flow rates, unique exhaust configuration, and a large volume of dilution (ambient) air in the exhaust gas stream. A custom EPA Method 5 was used due to the physical configuration of the

Test Report
Executive Summary
Revision 1
June 2002
Page 2 of 8

test cell. The nature of the location did not permit a full cross-section traverse; instead, single point sampling was performed via a slipstream. A verification was made through the use of tracer gas that the sample point was representative of the entire exhaust stream. The following is a list of the constituents of the exhaust stream that were measured along with the corresponding EPA test methods used:

- Filterable and condensable particulate (EPA Methods 5 and 202).
- Aldehydes and ketones (EPA 00111 and TO-05).
- Volatile organic.compounds (VOCs) (EPA Method 0030).
- Oxygen and carbon dioxide (EPA Method 3A).
- Carbon monoxide (EPA Method 10).
- Nitrogen oxides (EPA Method 7E).
- Non-methane hydrocarbons (NMHCs) (EPA Method 25A).

Sampling was not performed for sulfur dioxide and metals in the engine exhaust streams. Historic testing of metals provided random results with a number of interferences. Sulfur dioxide emissions were reported based on the procedure documented by AFIERA. This procedure estimates that sulfur dioxide emissions can be estimated by assuming all sulfur in the fuel undergoes complete oxidation to SO₂. The emission factor for SO₂ is provided in this report. JP-8 fuel samples were also collected for metals analysis. Dioxins/furans and other HAPs not listed in this report would not have been emitted in significant quantities to be readily detected by conventional sampling methods. Therefore, these compounds were not part of the emissions testing program.

Ambient air samples were collected and analyzed to correct for background conditions and thus reduce any potential bias. Ambient air samples were analyzed for many of the same compounds found in the exhaust stream. Ambient air samples were collected concurrent with emissions testing to account for emissions from large nearby sources (e.g., exhaust from other test cells) having the potential to bias the test results.

Ambient samples were collected for the following compounds:

From EPA SW-846.

Test Report
Executive Summary
Revision 1
June 2002
Page 3 of 8

- Particulate TSP (40 CFR, Part 60, Appendix B).
- Semivolatiles (EPA Method TO-13).
- VOCs (EPA Method TO-14).
- CO₂ (EPA Method 3A)
- CO (EPA Method 10)
- NO_x (EPA Method 7E)

During the sampling program, ambient pollutant concentrations were subtracted from source concentrations to account for background levels. During the program, background concentrations of pollutants were generally in the <1 to 20 percent range when compared to source concentrations. Background concentrations were highly dependent on local background sources.

II.1 Engine Testing Considerations/Complications

The engine was tested at five actual flight settings. Nominal engine conditions for emissions sampling are provided below:

- Idle (I), 10% power
- Approach (A), 20% power
- Intermediate (N), 70% power
- Military (M), 100% power
- Afterburner (AB), 150% power

Emissions tests comprised three 1-hour sampling runs for each pollutant at each power setting with the exception of the aldehydes/ketones tests. Due to sample volume requirements needed to meet method detection limits, aldehydes/ketones were collected over a 3-hour sampling period. Only two test runs were conducted at intermediate and military. The F119-PW-100 could not be operated continuously at military or afterburner maximum power for one continuous hour in order to prevent engine and/or test cell damage. The sample run time in the higher operative modes was reduced to a "safe" operating period. The sample collection procedures were reduced to accommodate the reduced operating time. In order to reach the analytical detection limit for the target pollutants, the sample team paused the sample run at the end of the safe operating period, waited as the engine was allowed to cool, then resumed sampling for the next operating period until the 1-hour sample run was

Test Report
Executive Summary
Revision 1
June 2002
Page 4 of 8

completed. At the afterburner setting, a single 10-minute sample run was conducted for gaseous pollutants only.

III.0 RESULTS

III.1 Criteria Pollutants

Results of the gaseous emissions testing are presented in Table III-1. The tables present both emission rates and factors for NO_x , CO, total particulate, NMHC, and CO_2 for each engine at each engine test condition. The emissions presented are the average of three 1-hour sampling runs. Results of individual runs are presented in Section 6 of this report.

III.2 Hazardous Air Pollutants

Table III-2 depicts the average HAP emissions for each power setting. These tables combine and summarize volatile and aldehyde/ketones compounds. The 10 HAPs shown in Table III-2 are the most frequently detected HAPs that are combustion by-products. Within this table, HAPs have been totaled for each power setting. The remaining HAP data that was analyzed during this sampling program is presented in Section 6 of this report.

IV.0 CONCLUSIONS

The following conclusions pertain to future engine testing and data analysis. During the testing program over 120 individual compounds were sampled and analyzed, but only a small percentage of those compounds was detected repeatedly. Those compounds that were detected had concentrations significantly above the analytical detection levels. Depending on the use of this data, it may be justifiable to reduce the compounds sampled in subsequent programs to only those compounds that were detected during this program. This is based on the assumption that sufficient HAP data was gathered during this program that can be directly applied to future engines. Any future sampling must take into account what the potential use of the data may be

Test Report
Executive Summary
Revision 1
June 2002
Page 5 of 8

(health risk, HAP qualification/quantification, regulatory, etc.) and then determine what compounds need to be sampled.

Likewise if similar test methodologies, as applied during this program, are used to collect and analyze for various compounds, no significant cost savings would be achieved in reducing the number of compounds analyzed for in a specific test method (i.e., sampling for VOCs by EPA method 0030 and only analyzing for benzene, toluene, and xylene). If sampling is conducted by an alternate method requiring significantly less effort to collect the sample and analyze for fewer compounds, a significant cost savings may be achieved.

The data collected during this program can also be reviewed to determine if surrogate compounds can be used to predict other HAPs (i.e., can benzene be used to predict formaldehyde). Based on the data currently available, however, there are not sufficient data points at each engine conduction to do a meaningful analysis. If additional data was available, primarily at those engine conditions that have the highest emission rates, a statistically significant analysis could be conducted.

- Benzene, toluene, and xylene represent the most significant VOCs measured during the program.
- Formaldehyde surrogate for aldehydes group. Formaldehyde accounts for over 90% of total aldehydes/ketones. Future sampling should only be done for formaldehyde.
- Most HAP emissions occur during the idle and engine setting. Future testing should concentrate on these modes to characterize emissions.
- An alternative particle sampling methodology is necessary. Using EPA
 Method 5 in an attempt to meet regulatory testing requirements is not
 necessary. The sampling environment is at or below the Method 5 detection
 limit.
- The particles are predominately less than 2.5 microns in size (range from 70% 80% of the total particles). As the fuel firing rate increases, the percentage of particles less than 2.5 microns also increases. These particles are primarily carbon soot. The larger particles, 2.5 to 10 microns, were found to be agglomerates of smaller combustion particles. These agglomerates accounted for 4.1% to 10.8% of the particle total. The largest particles, 7.5 to

Test Report Executive Summary Revision 1 June 2002 Page 6 of 8

10+ microns, were found to be angular particles that are believed to have been cooled and deposited on a surface and suspended during the test program. These particles are not considered a combustion product during testing. These particles ranged from 0.7 to 4.3% of the particle total.

Test Report
Executive Summary
Revision 1
June 2002
Page 7 of 8

TABLE III-1 F119-PW-100 CRITERIA POLLUTANT SUMMARY

	A THE RESIDENCE AND ADDRESS OF THE A	ldle	App	Approach	Intern	Intermediate	MIII	Military	After	Afterburner
Exhaust Flow,	(;							
dscfm	8	670697	99	663582	974	974449	1294	1294958	182	1821290
						lbs/1000		lbs/1000		lbs/1000
		lbs/1000 lbs		lbs/1000 lbs		sql		sql		sql
	lb/hr	fuel	lb/hr	fuel	lb/hr	fuel	lb/hr	fuel	lb/hr	fuel
NOxª	4.1	3.0	18.1	6.6	125.4	12.4	368.8	19.8	369.8	7.4
C0	66.3	48.2	21.7	7.9	21.6	2.1	14.0	8.0	807.7	16.1
NMHC	9.4	6.8	0.9	0.3	5.3	0.5	0.0	0.0	9.3	0.2
Total										
Particulate	3.43	2.49	5.49	2.00	14.24	1.41	20.92	1.12	(c)	(c)
a = Reported as NO ₂	4O ₂									
b = Total Non-Methane Hydrocarbons	hane Hydro	carbons								
c = Particulate sampling not conducted at afterburner	mpling not	conducted at a	nterburner							

Test Report
Executive Summary
Revision 1
June 2002
Page 8 of 8

TABLE III-2 F119-PW-100 HAZARDOUS AIR POLLUTANT SUMMARY

tem en	***************************************		3 ** · ** · ** · ** · * · * · * · * · *					
		ldle	App	Approach	Intern	Intermediate	Z	Military
Fush and Flass should	7	000	ì		t		į	
LAHOUST FIUW, USCITTI	707	203023	ģ	20CC00	9/1	9/4449	77	129495B
		lbs/1000		lbs/1000		lbs/1000		
		sql		sql		sql		lbs/1000 lbs
Pollutant	lb/hr	fuel	lb/hr	fuel	lb/hr	fuel	lb/hr	fuel
Formaldehyde	1.3740	8266.0	0.0975	0.0356	0.2473	0.0245	0.1413	0.0076
Acetaldehyde	0.1527	0.1109	0.0185	0.0068	0.0264	0.0026	0.0155	0.0008
Acrolein	0.0496	0960.0						
Isobutyraldehyde / MEK 3	0.0916	9990'0						
Benzene	0.1453	0.1055	0.0091	0.0033	0.0069	20000	0.0091	0.0005
Toluene	0.0877	2690.0	0.0007	0.0003				
Ethylbenzene	0.0226	0.0164	0.0012	0.0004	0.0050	0.0005	0.0034	0.0002
m,p - Xylene	0.0539	0.0391	0.0015	9000.0			0.0057	0.0003
o-Xylene	0.0384	0.0279	0.0009	0.003	0.0049	0.0005	0.0031	0.0002
Styrene	0.0430	0.0312	0.0012	0.0004				
Total HAPs	2.0587	1.4950	0.1307	0.0477	0.2906	0.0287	0.1781	9600.0
a - Analytical "peaks" overlap preve	enting deterr	nination of a	single com	pound. Rest	ılt could be	either comp	onnd or cor	overlap preventing determination of a single compound. Result could be either compound or combination of b
Blanks represent a non-detect value.	Ö					Andrea est de de la competito		

SECTION 1

INTRODUCTION

This Emission Summary Scientific and Technical Report has been prepared by Environmental Quality Management, Inc. (EQ) under Delivery Order 0008 of the Occupational and Environmental Health Assessments Contract (Contract Number F41624-95-D-9019) supporting the Air Force Occupational and Environmental Health programs around the world. This contract is administered by the Air Force Institute for Environment, Safety, and Occupational Health Risk Analysis/Risk Analysis Environmental Quality (AFIERA/RSEQ), Brooks Air Force Base (AFB), Texas.

The project requirements are described in the delivery order and its attached Statement of Work and Contract Data Requirements Lists (CDRL's).

The project includes:

- Preparation of the SAP (submitted August 2000, A004).
- Preparation of the Site Survey Report (submitted 6 April 2000, A011).
- Preparation of monthly progress, status, and management reports (A001).
- Preparation of conference agenda and minutes (A008).
- Preparation of a summary Scientific and Technical Report (this document, A003).

A description of the project background and objectives is provided in this section.

1.1 PREVIOUS STUDIES

The USAF began to develop a database of known engine emissions data in the 1970s. The purpose of developing the database was to produce a catalog of smoke plume opacity and gaseous emissions from engine test facilities. Environmental managers could use data from the catalog to meet regulatory reporting requirements. Subsequently, the USAF and the U.S. Navy (USN) have attempted to amass and review existing engine emissions data, validate the data, and identify data gaps. The USAF's Engineering and Services Laboratory and Engineering Services Center, and the

USN's Environmental Support Office have been the lead organizations for this effort. Available aircraft emissions technical references were compiled and reviewed by the U.S. Environmental Protection Agency (U.S. EPA) in 1993. The current effort is being undertaken by the USAF's AFIERA/RSEQ located at Brooks AFB, TX.

1.2 BACKGROUND

In 1973, the Defense Energy Task Force recommended that assertive action be taken to standardize U.S. Department of Defense (DOD) fuels. The Joint Logistics Coordinating Group, established to perform the standardization studies, recommended that the U.S. Air Force (USAF) replace naphtha-based JP-4 (MIL-T-5624) with the kerosene-based JP-8 (MIL-T-83133) as the standard turbine fuel. JP-8 is similar to commercial-grade jet engine fuel Jet A-1, with two additives previously required in JP-4. The hydrocarbon fuel is composed of various medium molecular weight organic compounds including paraffins, olefins, and aromatics. JP-8 specifications require a maximum olefin and aromatic content of 5% and 25% by volume, respectively. The maximum allowable sulfur content to meet the specifications of JP-8 is 0.3% by weight. The guaranteed minimum net heating content of the fuel is 18,400 Btu/lb. Table 1-1 lists the general specifications of JP-8 jet fuel. JP-8 fuel also contains several additives. Ethylene glycol monomethyl ether (EGME) is added as a fuel system icing inhibitor. Corrosion inhibitors and antistatic additives are also required to meet JP-8 specifications. Antioxidant and metal deactivator additives are optional for JP-8.

The principal reasons for replacing JP-4 with JP-8 were the following:

- Standardize military fuels with commercial aviation kerosene (Jet A-1).
- Be consistent with the ongoing standardization efforts in the North Atlantic Treaty Organization (NATO).
- Improve safety (JP-8 is less volatile than JP-4).
- Eliminate expenditures required for fuel evaporative equipment.

Test Report Section 1 Revision 1 June 2002 Page 3 of 5

TABLE 1-1. U.S. MILITARY SPECIFICATIONS OF TURBINE FUELS, JP-8 USAF MIL-T-83133A-AMD.1; 4 APRIL 1980; KEROSENE OR JP-8

Composition	(Acidity, Total; mg KOH/g)	0.015
	Aromatics	25.0
	Sulfur, Mercaptan; wt %	0.05
	Sulfur Total; wt %	0.3
	Color, Saybolt	0.3
Volatility	Residue; vol % for D-86	1.5
	Loss vol % for D-86	1.5
,	Flash Point; ° C	38
	Gravity; ° API at 15° C	37-51
	Density; kg/m³ at 15° C	775-840
Fluidity	Freezing Point; ° C (° F)	-50 (-58)
	Viscosity; cSt at -20° C	· 8.0 ´
Combustion	Smoke Point	19.0
	Hydrogen Content; wt %	13.5
Stability	JFTOT delta P; mm HG	25
•	JFTOT Tube Color Code	< 3
Contaminants	Existent Gum; mg/100 ml	7
	Particulates; mg/liter	1
	Water Separation Index, Modified	70ª
Additives	Anti-icing; vol %	0.10 to 0.15
	Antioxidant	Option
	Corrosion Inhibitor	Required
	Metal Deactivator	Option
·	Anti-static	Required
Other	Conductivity; pS/m	200 to 500
	Service	USAF
	NATO Code No.	F-34; F-35 ^b

^a With all additives except electrical conductivity additive.

Source:

Handbook of Aviation Fuel Properties, Coordinating Research Council, Inc., Society of Automotive Engineers, Inc. General Publications, Warrendale, PA 15096, 1983.

1.3 PROJECT OBJECTIVES

^b Same as JP-8 without additives.

Test Report Section 1 Revision 1 June 2002 Page 4 of 5

Although engine emissions from combustion of JP-4 are well documented for criteria pollutants. 1 little information exists for hazardous air pollutants (HAPs) from combustion of JP-8 fuel. Due to intrinsic differences between these two raw fuels, their combustion products may differ. As part of a broader engine-testing program, the USAF, through the Human Systems Center (HSC) (now AFIERA/RSEQ) at Brooks Air Force Base, TX, contracted to have the emissions characterized from 17 aircraft engines, 2 helicopter engines, and 2 auxiliary power units (APUs) operating at a variety of settings. Criteria pollutants and targeted HAP emissions were quantified during the test program. Emission test results are used to develop emission factors for the aircraft engines and APUs tested. The USAF intends to develop a mathematical relationship. using the data collected during the previously completed tests and this sampling effort. to extrapolate existing JP-4 emission factors to representative JP-8 emission factors for the remaining untested engines. Past sampling events are detailed in Volumes 1, 2 and 3 of the Aircraft Engine and Auxiliary Power Unit Emissions Testing Final Report, EQ, 1998. This Addendum to that report details the testing program completed for the F119-PW-100 engine.

The overall focus of the program is to determine engine emissions from each test facility as the emissions exit to the atmosphere as opposed to directly behind the engine. The engine emission data from the test source will be utilized for engine "Bed Down" and conformity analysis for compliance with state implementation plans and federal implementation plans for the purpose of attaining or maintaining the national ambient air quality standards.

1.4 CURRENT TESTING PROGRAM

Criteria pollutants are pollutants for which National Ambient Air Quality Standards (NAAQS) (see 40 CFR 50) have been established. They include: carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter, lead, and ozone (and its precursors).

Hazardous air pollutants (HAPs) are toxic chemicals and compounds regulated under Title III, Section 112(b) of the Clean Air Act Amendments of 1990 (CAAA). Presently, there are 189 HAPs.

Test Report Section 1 Revision 1 June 2002 Page 5 of 5

As part of the broader engine-testing program, the USAF, through the Human Systems Center (HSC) (now AFIERA/RSEQ) at Brooks Air Force Base, TX, has contracted to have the emissions characterized from the F119-PW-100 engine operating at a variety of settings utilizing JP-8 fuel. Testing of the F119-PW-100 engine conducted during the week of September 11, 2000 at the Lockheed Martin Aeronautical Systems Facility is the focus of the sampling effort described within this document.

1.4.1 F119-PW-100

Two F119-PW-100 turbofan engines power the F-22 Raptor aircraft. Pratt & Whitney manufactures these engines at its Florida Operations Center. The maximum thrust of the engine is in the 35,000 pound class; however, the engine is experimental and no other data was available prior to the sampling program.

1.4.2 Test Facility

The F119-PW-100 engine was sampled at the Lockheed Martin Aeronautical Systems (LMAS) facility located in Marietta, Georgia. The LMAS Facility is a contractor facility which develops, manufactures, and tests a variety of military and rocket engines. Testing was conducted within a facility hush house.

SECTION 2

FACILITY AND SAMPLING APPARATUS DESCRIPTION

As stated in Section 1, testing of the F119-PW-100 engine was performed at the Lockheed Martin Aeronautical Systems (LMAS) facility utilizing JP-8 jet fuel. Due to the physical layout of the LMAS hush house testing location, the engine exhaust could not be sampled safely or cost-effectively using traditional EPA-recommended emission testing methodologies. In addition, the traditional International Civil Aviation Organization (ICAO) sampling method does not address particulate or HAP analysis. A description of the hush house, sampling system apparatus, and general sampling methodology is provided in this section. A more detailed description of the sampling methodology is provided in Sections 3 and 4.

2.1 LOCKHEED MARTIN AERONAUTICAL SYSTEMS (LMAS) TEST FACILITY OVERVIEW

Military aircraft jet turbine engines are tested in indoor enclosures designed to restrain the engine or aircraft and to provide suitable environmental protection while testing occurs. These facilities are also known as hush houses. The building functions include supply air filtration, noise suppression, exhaust diversion, and technical support for various test functions. The layout of a typical hush house interior and exterior are illustrated in Figures 2-1and 2-2. During the test process, aircraft or isolated engines are mounted in the rear of the hangar-like enclosure with the exhaust nozzle pointing toward the augmentor tube and out of the building (Figure 2-3). The engine exhaust is directed out of the test facility and into the ambient air via a horizontal elliptical duct (the augmentor tube) which finally directs the air flow upward via a terminal deflector plate in

the blast box (Figure 2-4). The hush house emits combustion products mixed with filtered dilution air directly to the atmosphere at the augmentor tube terminus.

For this test program, the test team collected samples directly behind the engine exhaust nozzle at two engine settings and prior to the exit of the hush house augmentor tube, near the point of entry into the blast box at all engine settings.

2.2 ENGINE EXHAUST SAMPLING RAKE SYSTEM

As part of the test program at LMAS, gaseous emissions directly behind the engine were measured at timed intervals in a similar manner described by ICAO at the idle and approach engine settings. Engine exhaust sampling was conducted using a cruciform rake mounted approximately 2.5 feet downstream from the exhaust. The intent of the ICAO mounting location parameters were considered for rake placement. A schematic diagram of the rake assembly is illustrated in Figure 2-5. This system was utilized during a previous test program and was obtained by AFIERA for use during this portion of the engine study. The rake contains 12 ports spaced across four rake arms, each of which contains a 1/8-inch orifice. A mixed exhaust sample was drawn from the 12 ports and transferred via a single stainless steel tube through filtered and heated Teflon® lines to the combustion and diluent gas conditioning system and analyzers. The photograph in Figure 2-6 shows the rake assembly mounted behind the F119-PW-100 engine. The rake was installed behind the engine during the idle and approach phases of the testing program. The rake was removed during the remaining engine settings in order to eliminate the potential for engine or hush house damage.

2.3 AUGMENTOR TUBE SLIPSTREAM SAMPLING SYSTEM

Access to the area of emissions exhaust is restricted during operation of engines in the hush house due to safety concerns including high temperatures, high velocity and vibration, excessive noise, and the potential of exposure to the exhaust gases. It was therefore necessary to devise a sampling scheme that allows sampling to be conducted

from a remote location that required modification to existing point source EPA emission test procedures.

The slipstream sampling system shown in Figures 2-7, 2-8 and 2-9 was constructed to measure jet engine emissions from the Langley AFB hush house as part of the F100-PW-100 jet engine emission tests conducted in November 1996. Similarities between that testing program and the current sampling effort allowed the sampling system to be applied to the F119-PW-100 engine sampling program completed at the LMAS facility hush house. The system was designed to extract an augmentor tube exhaust sample and to permit use of standard source emission test methods that could not be applied immediately behind the test engine or in the augmentor tube.

A stainless steel pipe, 10 inches in diameter, was utilized to extract a side-stream sample of the diluted engine emissions at a point upstream of the augmentor tube exit. The duct was centered in the augmentor tube and extended approximately 10 feet into the augmentor tube. The duct was supported inside the augmentor tube by two sets of support stands. The duct was directed horizontally toward the rear of the blast box and then turned at an angle out of the blast box to the top of the deflector shield wall, where a transition to a 24 inch by 24 inch square duct occurred. The duct was constructed of stainless steel seamless pipe with flanged ends. Each section was bolted together at the flanged end. Each piece was 10 feet in length except for the inlet and elbows. Any welds in the duct system were factory welds. The larger square duct provided a decrease in gas velocity and a suitable sampling location for applying standard emission testing methods. The inlet to the slipstream was circular, similar to the inlet of a large Method 5 sampling nozzle. At the end of the square duct was a deflector plate to vent emissions upward away from ground activities (See Figures 2-10, 2-11 and 2-12).

The stainless steel slipstream ductwork was supported inside the augmentor tube by attaching pipe risers to existing bolts in the U-channels inside the augmentor tube. Two radial stands were used inside the augmentor tube.

Attachments were made to the 10-inch pipe with 10-inch pipe collars and bolts. All bolts were secured with a washer, lock washer, and a nut. Bulkhead fittings were used to provide sampling ports through the C-Channel in the first support brace. The same inlets were constructed of four pieces of 1/4 inch C-Channel extending from the duct radially outward (at 90° angles) to the wall of the augmentor tube to create the slipstream rake. Sampling lines and thermocouples were directed through an iron pipe conduit to the exit. The conduit was secured to the supporting braces via bolts and U-clamps. The duct was then fastened to the blast box and supporting scaffolding outside the blast box. This approach provided structural integrity, reduced the cross sectional exposure profile of freestanding duct, and subjected the duct only to radial flow forces on the plate, or turbulent forces along the entire exposed length. Twelve sampling points were used for gaseous sampling inside the augmentor tube. Scaffolding fixed to the hush house and ground supported the rectangular ductwork outside the hush house. Scaffolding was secured to each other and to 1/2-inch-thick plywood on the ground to provide further vibration support.

This sample collection structure provided full use of the hush house for purposes other than emission testing. Once the sampling structure was installed, the hush house was available for testing of other engines as needed. The structure did not interfere with the normal operation of the hush house.

Engine exhaust samples were collected at multiple locations along the slipstream. Gaseous emission (CO, NO_x CO₂ and VOC) samples were collected at the slipstream rake from 12 sample ports installed in the brace. Particulate and HAP emission samples were collected from sample ports in the slipstream duct outside of the hush house.

The locations of the sampling points for the slipstream sampling rake were positioned using EPA Method 1 criterion. Since the duct was oval shaped and EPA Method 1 does not accommodate this configuration, the points were determined across the major axis assuming a circular diameter. Similarly, the points across the minor axis

Test Report Section 2 Revision 1 June 2002 Page 5 of 17

were calculated assuming a circular diameter. The slipstream duct was positioned in the center of the augmentor tube. Although the oval cross sectional shape of the augmentor tube is not addressed in EPA Method 1, locating the sampling point inlet at least 1/2 duct diameter prior to the exit of the tube was consistent with the basic tenets of EPA Method 1. Samples of the augmentor tube exhaust were obtained for combustion and diluent gas analysis using the slipstream rake assembly mounted in the augmentor tube.

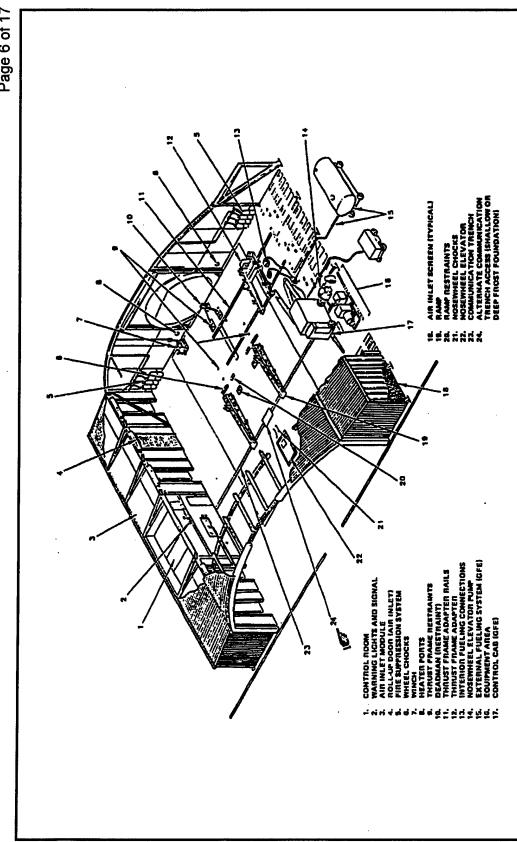
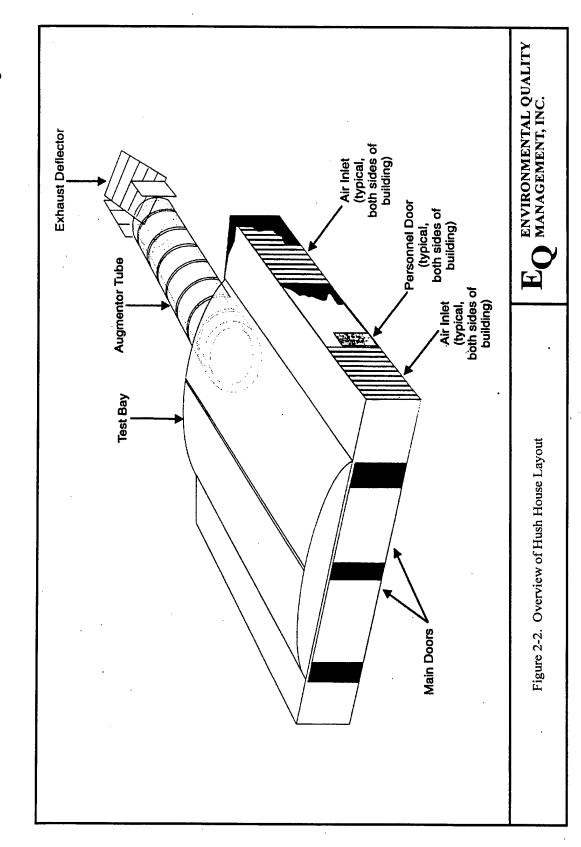


Figure 2-1. Overview of Hush House Physical Layout

EQ MANAGEMENT, INC.



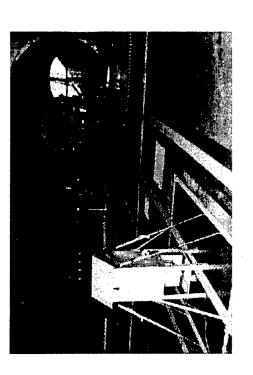


Figure 2-3. Engine Mounted for Testing in Hush House

EQ MANAGEMENT, INC.

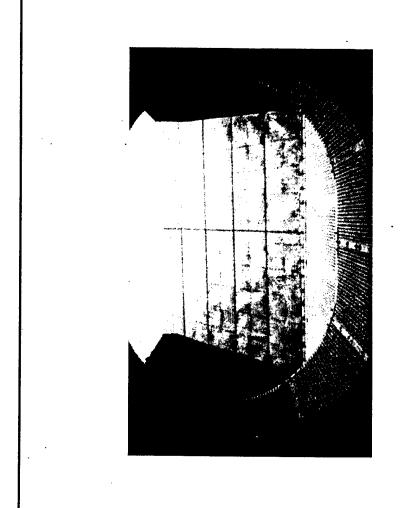
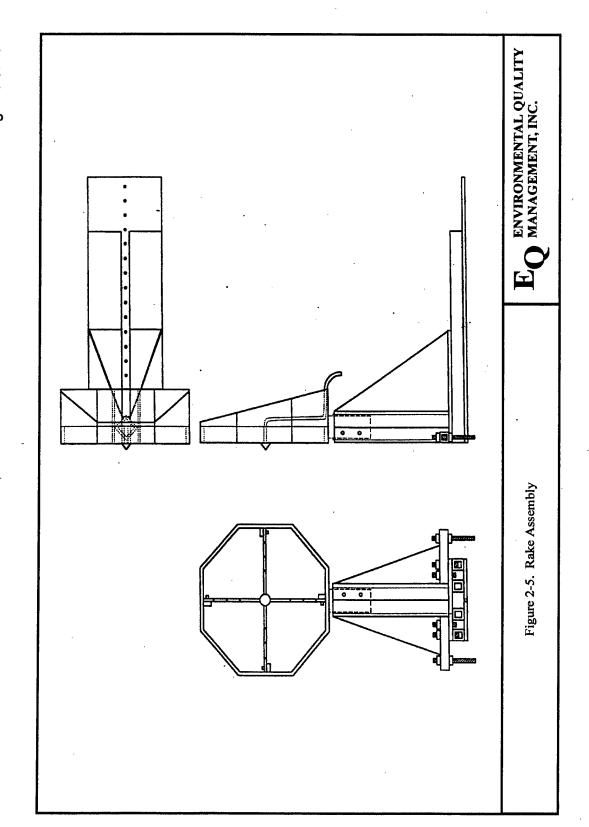


Figure 2-4. Exhaust Deflector Plate

E MANAGEMENT, INC.



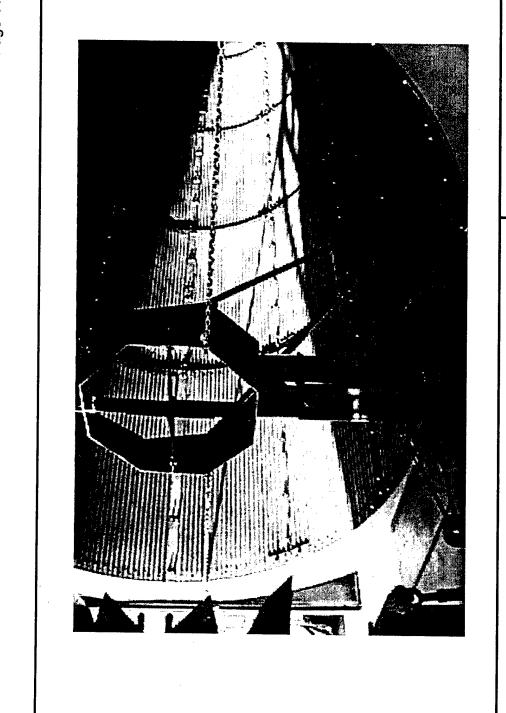
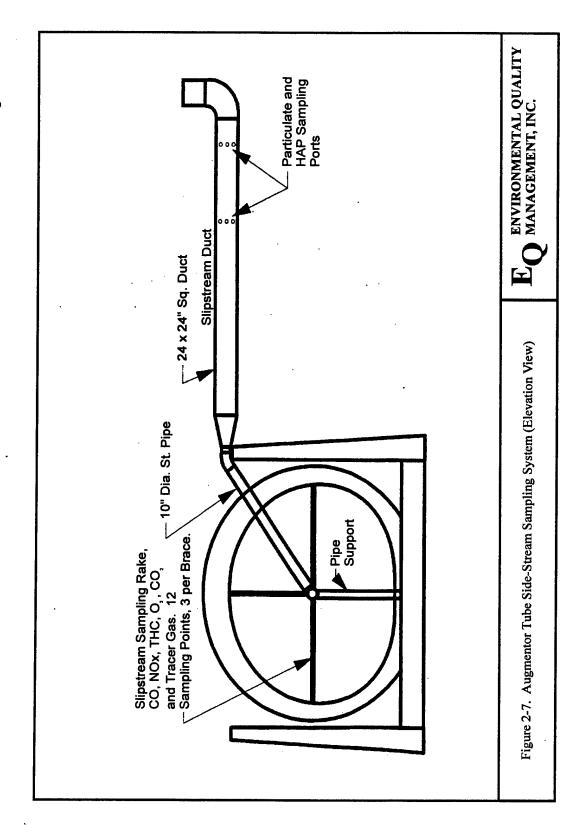
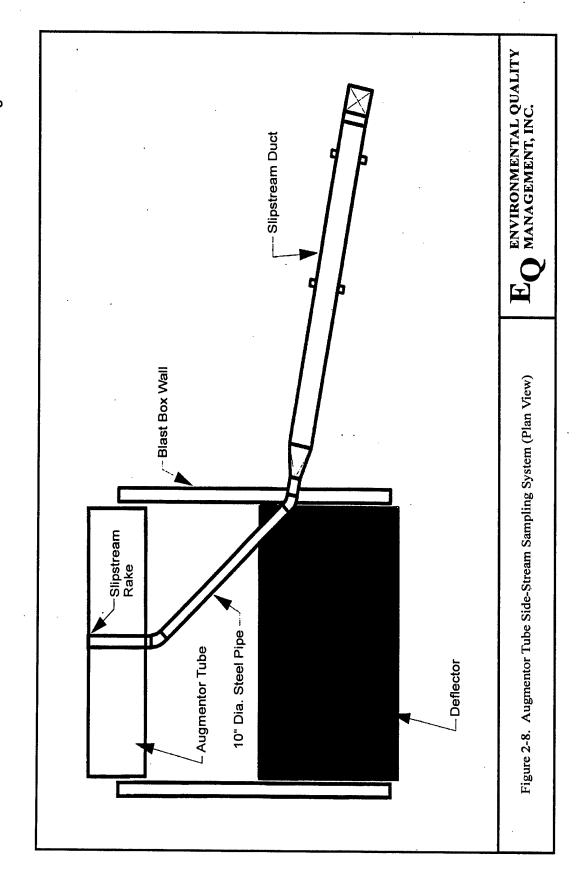
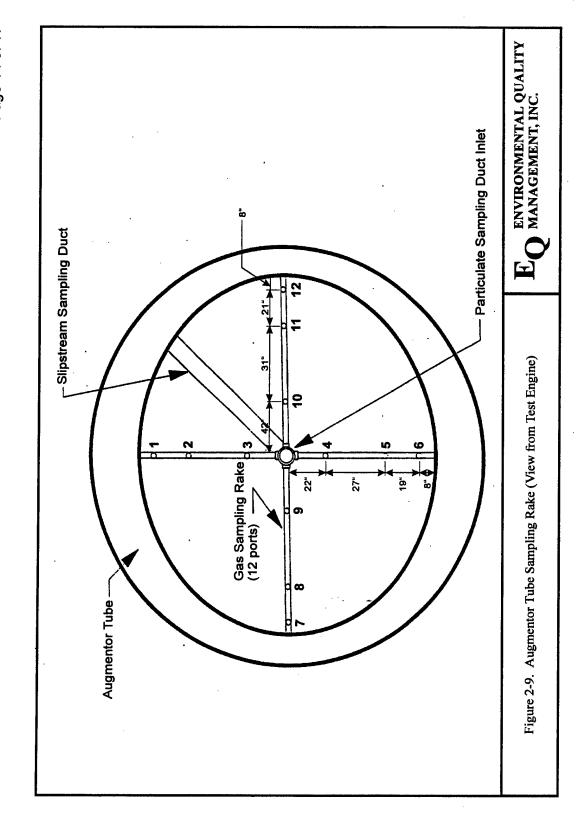


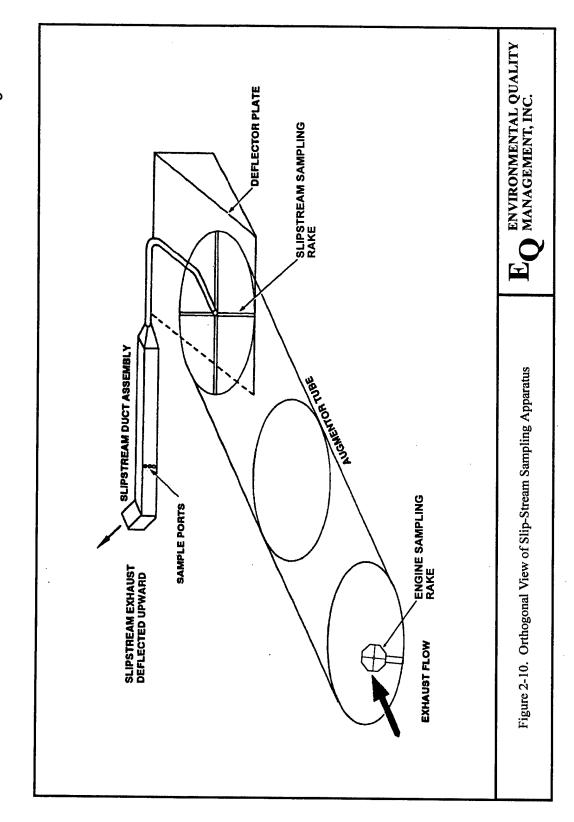
Figure 2-6. Engine Sampling Rake

EQ MANAGEMENT, INC.









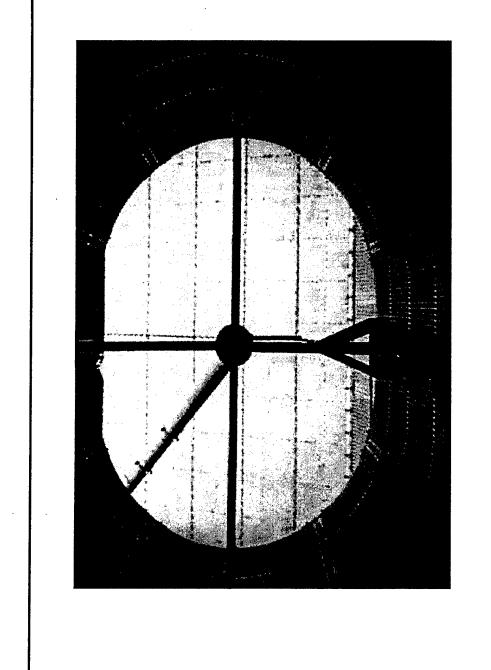


Figure 2-11. Augmentor Tube Side-Stream Extraction Tube and Gas Sampling

EQ MANAGEMENT, INC.

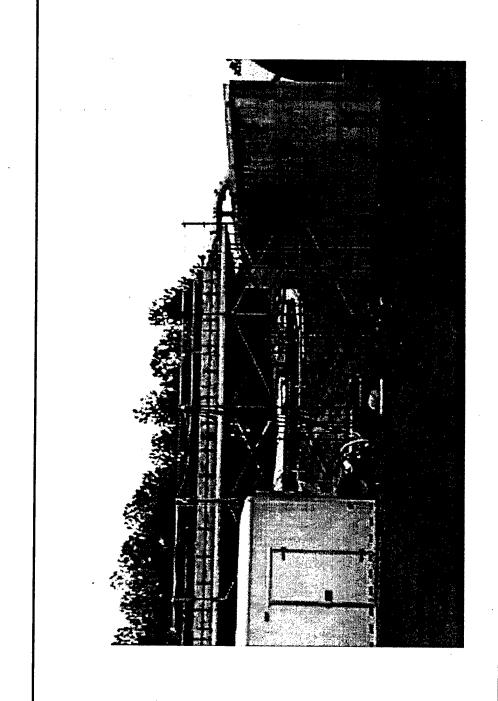


Figure 2-12. Augmentor Tube Side-Stream Sampling System Duct

EQ MANAGEMENT, INC.

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SECTION 3

SAMPLING PROCEDURES AND METHODS

The testing program involved sample collection at three locations: 1) directly behind the engine (gaseous emissions, benzene and formaldehyde), 2) at the hush house augmentor tube exit (particulate and HAP), and 3) at the intake to the slipstream inside the augmentor tube (gaseous emissions). The purpose of the multiple sample locations was to note the variance (if any) in gaseous emissions (CO, NO_x, VOC) inside the hush house augmentor tube and to look at pollutant dilution and secondary pollutant formation by sampling directly behind the engine. (During the idle and approach slipstream sample runs, an approximate 30-minute sample was collected from the engine sampling rake). The focus of the program was to verify engine emissions from the hush house.

The determination of emissions from the engine test stand through the hush house augmentor tube presented a unique challenge to accurately measure emission rates of the target pollutants. A number of constraints and unknown parameters were present sampling this engine that are not associated with a more traditional emissions testing programs. These variables were difficult to account for because of the inability to measure outlet flow parameters. The flow parameters included flow rates, temperature, and dilution of ambient air in the exhaust gas stream. The program was designed to allow for those variables so that representative data could be collected in a timely and cost-effective manner.

3.1 GENERAL SAMPLING CONSIDERATIONS/COMPLICATIONS

Access to the area of emissions exhaust was restricted during operation of engines in the hush house due to safety concerns including high temperatures, high velocity

and vibration, excessive noise, and the potential of exposure to the exhaust gases. It was therefore necessary to devise a sampling scheme, which allowed sampling to be conducted from a remote location, which required some modification to existing test procedures. The slipstream sampling approach allowed particulate matter and HAP testing personnel to be located outside the exclusion zone.

The physical structure of the exhaust through the augmentor tube did not allow for use of the traditional isokinetic sampling methodologies. Complicating factors included large amounts of dilution air and limited testing windows. Based on these considerations, several assumptions were made to address the unique nature of this program. Assumptions included homogeneous mixing of the exhaust stream (verification of this assumption was made in the field); theoretical methods for determining air flow through the system; and particulate distribution behavior equivalent to gaseous. These assumptions were based on previous engine testing programs and reference documents.

3.1.1 Pollutant Distribution in the Augmentor Tube

The test program was based on the assumption that, as the exhaust gas exits the test stand through the augmentor tube, the exhaust stream from the engine and the dilution air have reached a homogeneous mixture. This assumption had been validated in testing conducted by EQ at Edwards AFB (EQ Report, Source Sampling and Testing of Aerospace Equipment and Jet Engines at Edwards AFB, CA) and by Radian Corporation at Langley and Cannon Air Force Bases (presentation by Captain Gregory Durand, USAF at the 89th Annual Meeting and Exhibition of the Air and Waste Management Association, Emission Factors for JP-8 Combustion Sources). The gas stream was found to be homogeneous in the hush house augmentor tube at approximately 60 feet behind the jet engine exhaust point. The complete mixing of exhaust gases and the dilution air are the result of the very turbulent flow from the jet engine exhaust. This is discussed further in Section 6.

Particulate size distribution in the engine exhaust was shown to be significantly less than 10 microns (µm) in size (Characterization of Chemicals on Engine Exhaust Particles: F101 and F110 Engines, ESL-TR-89-20, Air Force Engineering and Services Center Engineering and Services Laboratory and Source Sampling and Testing of Aerospace Equipment and Jet Engines - Test Protocol - Edwards AFB, CA, EQ December 1995). Typically, and in the case of this test program, the majority of particles are less than 2.5 µm. Because of the size of the particles, it was assumed that they would behave as an aerosol or gas and that pollutants would be distributed evenly throughout the test stand exhaust. The basis for this assumption was also discussed in the reference Air Pollution, Its Origin and Control by K. Wark and C. Warner, published by Harper & Row Publishers, 1981. Since it was assumed that all particulate (and those contaminants bound to the particulate) would behave as an aerosol, the stack or any point in the stack would have the same concentration of pollutants. This assumption was used as the basis to conduct single-point isokinetic sampling at one point in the exhaust, which was representative of all points in this engine test exhaust. This was justified during the test program and is presented in Section 6.4.

Because it was assumed, and had been documented, that the majority of the particulate was less than 10 μ m, EPA Method 5 was used. The particulate filters were analyzed by a scanning electron microscope (SEM) to confirm the particle morphology and size distribution. The distribution was based on the particle count in each size range. In addition, an experimental real time sampler was utilized to collect particulate matter samples. Sampling methodologies for particulate are discussed in Section 3.2.4-1. A cascade impactor was considered to determine the particle size distribution by mass. Due to the expected low particulate concentrations, the impactor would not be effective in collecting a quantitative sample. Also, the size range of each stage of the impactor is larger

than the expected particle diameter; therefore, all particles would be collected on the final stage.

Although it was assumed that pollutant concentrations in the augmentor tube would be homogeneous, this assumption was verified by the use of tracer gas. The tracer gas, sulfur hexafluoride (SF_6), was dispersed from multiple points outside the hush house into the engine exhaust gas stream as it entered the augmentor tube and was measured near the outlet at multiple points on the slipstream support brace. Based on the turbulent flow of the exhaust and the passage of the exhaust gases through the silencer, the SF_6 was dispersed equally in the exhaust. A random number of the 12 sample points from the slipstream cross brace were sampled at various engine settings to verify that the tracer gas was dispersed equally. Further discussion of tracer gas methodology is included in Section 4.1 of this document.

3.2 EMISSION TESTING

Sampling was performed for criteria pollutants and those HAPs that are products of incomplete combustion (PICs). The following compounds were monitored from the slipstream system sampling:

- Filterable and condensable particulate (EPA Methods 5 and 202).
- Aldehydes and ketones (EPA Method 0011).
- Volatile organic compounds (VOCs) (EPA Method 0030), including 1,3 Butadiene.
- Oxygen and carbon dioxide (EPA Method 3A).
- Carbon monoxide (EPA Method 10).
- Nitrogen oxides (EPA Method 7E).
- Total hydrocarbons (THCs) (EPA Method 25A).
- Methane (EPA Method 25A).
- Total particulate matter (Continuous monitor, experimental method).

The following compounds were monitored from the engine rake:

- Oxygen and carbon dioxide (EPA Method 3A).
- Carbon monoxide (EPA Method 10).
- Nitrogen oxides (EPA Method 7E).
- Total hydrocarbons (THCs) (EPA Method 25A).
- Methane (EPA Method 25A).
- Benzene and formaldehyde

The engine exhaust system was not sampled for sulfur dioxide, metals or semi-volatiles. Sulfur dioxide emissions were reported based on the procedure documented by AESO. This procedure estimates that sulfur dioxide emissions can be estimated by assuming all sulfur in the fuel undergoes complete oxidation to SO₂. The sulfur content in JP-8 fuel was determined during testing to assure consistency with published results. The emission factor for SO₂ is provided in this report. Concentrations of the following metals were not detected in the fuel analysis: antimony, arsenic, barium, beryllium, cadmium, cobalt, chromium, lead, manganese, mercury, nickel, selenium, silver and thallium. Dioxins, furans, semi-volatiles and HAPs not discussed in the subsequent text were not a target of this program and had the potential to be emitted in quantities too small to be detected by the sampling methods described in this program.

Grab samples were collected behind the engine at the engine rake to determine the concentration of benzene and formaldehyde. This was performed at the idle and approach engine settings to compare to the data collected at the slipstream.

The unique feature in conducting emissions testing for this engine was that the exhaust stream at the hush house exhaust was significantly diluted with ambient air. This presented three problems: (1) the volume of exhaust gas was significantly increased; (2) dilution of the exhaust may have made it difficult to detect various pollutants; and (3) the ambient air concentration of various pollutants may have been detectable by emissions test methods. These problems may have biased the engine exhaust emissions estimates on the high side. The volume of gas at the augmentor tube exhaust was not measured directly, but was calculated indirectly through a tracer gas and calculated by F-factor and carbon balance. Because of significant dilution with the ambient air, some compounds needed to be sampled for and composited over three runs to provide adequate sample volume to reach analytical detection limits. The background ambient air concentrations were variable and could significantly bias results since ambient concentrations may have been higher than the detection limit of the source sampling methods.

Ambient air sampling was conducted in conjunction with emissions testing to quantify and qualify background emissions concentrations. Ambient samples were collected at the air intakes for the following compounds:

- Particulate TSP (40 CFR, Part 60, Appendix B).
- VOCs (EPA Method TO-14).
- CO (EPA Method 10)
- NO_X (EPA Method 7E)
- CO₂ (EPA Method 3A)

It was not known which compounds would have been detected using the methods proposed because this level of testing for HAPs had not been documented on aircraft engine emissions. Based on the results for the first 17 engines, the program was modified by reducing the target number of HAPs collected (ambient and source). The target pollutant list was reduced based upon the lack of detection of semi-volatile HAPs. Ambient data for aldehydes and ketones was not consistent during past sampling efforts and therefore was removed from the target list.

3.2.1 Flow Rate Measurement

As stated previously, standard flow rate measurements could be performed at this test location. Additionally, there was a limited test window in which the inlet flow measurements could be taken. The identification of inlet flow rates was critical to determining the ambient contribution of pollutants in the inlet air. Outlet flow from the augmentor tube was determined by an indirect method (tracer gas) and theoretical methods (carbon balance and F-factors). Regardless of the SF₆ injection temperature, discussed in Section 4, the use of multiple-flow measurement/calculation methods was intended to provide a firm basis for identifying and rejecting outlier data. The flow data collected by any one method at a given condition was compared against the alternate measurement data collected at that same condition, as well as the flow data collected by all methods for the engine at different operating conditions. An established relationship was expected between engine operating level and total flow. All flow measurement methods provided valid data at one or more operating conditions. The

data evaluation identified which measurement deviated from that relationship, and whether that deviation could be attributed to a physical parameter such as temperature, oxygen concentration, etc. If the deviation was predicted (e.g., high oxygen concentration impact on F-factor calculation), that data was discarded. If there was no obvious physical explanation, best-fit estimates at other loads were used to identify and reject the outlier.

Inlet concentrations for some compounds were measured as part of the theoretical flow determination method using carbon balance and F-factors. At the inlet location, THC was measured using a hydrocarbon analyzer identical to the one that measured engine exhaust gas THC. An inlet carbon dioxide (CO₂) measurement was also required as input to the theoretical flow model. An ambient CO₂ monitor was used to measure the inlet CO₂ concentration during each test run.

Section 4 discusses in detail the methodologies that were applied to calculate air flow at the LMAS engine test facility.

3.2.2 Pretest Measurements

Preliminary test data were obtained at the slipstream during the shakedown runs. Preliminary flow rate data and gas composition data were collected. Augmentor tube and slipstream sampling geometry measurements were obtained and recorded, and sampling point distances verified. A preliminary velocity traverse was performed in the slipstream utilizing a calibrated S-type pitot tube and a Dwyer inclined manometer to determine velocity profiles. Exhaust gas temperatures were observed with a calibrated direct readout pyrometer equipped with a chromel-alumel thermocouple. Water vapor content was measured using EPA Method 4.

A check for the presence or absence of cyclonic flow was conducted in the slipstream. Preliminary test data were used for nozzle sizing and sampling rate determinations. Probe nozzles, pitot tubes, metering systems, and temperature measurement devices were calibrated on site as specified in Section 5 of EPA Method 5 test procedures.

3.2.3 Emissions Test Methods

The following paragraphs discuss methods that were utilized for emissions testing. Furthermore, Appendix B of this document presents the emissions sampling methods in greater detail, including descriptions of exhaust emissions test sampling trains, sample preparation, sample procedures, sample recovery, and analytical procedures.

<u>Particulate Sampling</u> - EPA Method 5 was used for particulate sampling at the slipstream exhaust. The sampling train utilized to perform particulate sampling conformed to EPA Reference Methods 5 and 202 for the collection of both filterable particulate and back-half condensable particulate. Select particulate samples were submitted for analysis of particle size distribution and shape. The particulate was analyzed using a scanning electron microscope (SEM) equipped with an IXRF iridium digital image system. Due to the low concentration of particulate matter in the exhaust, several sampling procedure comments were received from SPAWAR SYSCEN D3621. EQ incorporated the following suggestions:

- 47 mm diameter filters will be used
- The humidity in the weighing room will be less than 50%
- A balance accurate to 5 decimal places will be used.

Real Time Particulate Mass Determination - In addition to EPA Methods 5 and 202, an attempt was made to utilize an experimental TEOM® Series 7000 Source Particulate Monitor to collect real-time total particulate matter samples. However, the sampler could not withstand the vibrations on the test stand created by the engine thrust. Therefore, data collected by the sampler was limited and could be utilized only for particle size analysis. A more detailed description of the sampling apparatus and methodology is found in Appendix B.

Test Report Section 3 Revision 1 June 2002 Page 9 of 22

<u>Aldehyde and Ketone</u> - The sampling train utilized to perform aldehyde and ketone sampling conformed to BIF Method 0011.

<u>VOCs</u> - The sampling train utilized to perform VOC sampling conformed to EPA Reference Method 0030. Table 3-1 lists the VOCs that were analyzed for in each sample.

TABLE 3-1. SUMMARY OF SOURCE TARGET COMPOUNDS FOR VOLATILE ORGANIC COMPOUNDS

V	OST Compounds – Clean
	Air Act List
Acetone	Trans-1,2-Dichloroethene
Benzene	1,2-Dichlorophropane
Bromodichloromethane	Cis-1,3-Dichloropropene
Bromomethane	Trans-1,3-Dichloropropene
Bromoform	Ethylbenzene
2-Butanone	2-Hexanone
1,3 Butadiene	Methylene chloride
Carbon disulfide	4-Methyl-2-pentanone
Carbon tetrachloride	Styrene
Chlorobenzene	1,1,2,2-Tetrachloroethane
Chlorodibromomethane	Tetrachloroethene
Chloroethane	Toluene
Chloroform	1,1,1-Trichloroethane
Chloromethane	1,1,2-Trichloroethane
1,1-Dichloroethane	Trichloroethene
1,2-Dichloroethane	Trichlorofluoromethane
1,1-Dichloroethene	Vinyl acetate
Cis-1,2-Dichloroethene	M, P-Xylene
	O-Xylene

<u>Gaseous Pollutants</u> – EPA methods 7E and 10 were utilized to determine the concentration and mass emission rate of NO_x and CO, respectively.

Test Report Section 3 Revision 1 June 2002 Page 10 of 22

Methane and Non-methane Hydrocarbons (NMHC) — NMHCs were measured directly using a JUM Model 109A methane/non-methane hydrocarbon analyzer. The Model 109A contains two flame ionization detectors (FIDs). The sample is split before being sent to the respective FIDs. One fraction is passed through a catalytic converter to combust all non-methane hydrocarbons (to CO₂) before the sample is measured in the FID. The methane residual in the sample is the only component that is measured by that detector. The other sample fraction is sent to the second FID, which measures the total hydrocarbon concentration of the sample. Both FIDs are initially calibrated with a methane calibration standard, so both the total hydrocarbon and the methane residual are measured as methane. The difference between these two values is automatically determined and reported as non-methane hydrocarbons by the Model 109A.

The THC analyzer was challenged with a zero and span gas at the beginning and end of each sample day to calibrate and assess the instrument's calibration.

<u>Metals</u> - Emissions sampling was not completed for metal exhaust emissions. Fuel analysis for JP-8 was performed to determine the concentration of various metals in JP-8 fuel. The analytical procedure involved the combustion of JP-8 fuel in an evaporative dish. The combustion residue was ashed in a muffle furnace. Ash product was treated with an aqua regia to digest any residual carbon. The solution was diluted then analyzed via Inductively Coupled Plasma Spectroscopy, Cold Vapor Atomic Absorption Spectroscopy (Hg), or treated with chelating agent and analyzed via colorimetric methodology (P). Concentrations were determined for the metals listed in Table 3-2.

TABLE 3-2. SUMMARY OF SOURCE TARGET METALS FROM JP-8 FUEL ANALYSIS

1 1/0101 01	O I OLL AMALIBIS
Antimony	Arsenic
Barium	Beryllium
Cadmium	Cobalt
Chromium	Copper
Lead	Manganese
Mercury	Nickel
Phosphorus	Selenium
Silver	Thallium
Zinc	

3.2.4 Ambient Air Sampling

Due to the high ambient air dilution rate for the engine tests, background levels of gaseous pollutants were taken into account in determining the emissions from the hush house. For example, fuel handling operations in the area could have contributed to background hydrocarbons. Similarly, CO and/or NO_x levels could have been affected by vehicles, heavy machinery operating in the area, or aircraft emissions. The carbon balance methodology used for flow rate determination required ambient samples to be collected as part of the normal testing. A sample was collected from one side of the hush house near the air intake.

The ambient air sampling program was designed to collect air samples to be analyzed for pollutants in the following two major categories:

- Gases
- Particulates

Ambient air sampling, equipment operations, and calibration followed standard operating procedures (SOPs) for each method. Ambient air sampling was performed in conjunction with all emissions testing. Ambient air sampling commenced at the start of each emissions test run and was concluded at the completion of the final emissions test run. The ambient air samples were composited over the three 1-hour test runs for each engine power setting. Samplers were turned on and off manually. These results were used to correct for any bias introduced by pollutants found in the ambient air.

The following subsections present brief descriptions of the ambient air sampling and analytical methods used for each of the pollutants or pollutant groups. The descriptions include overviews of the sampling equipment, collection media, and analytical techniques used for each pollutant or pollutant group.

3.2.4.1 Particulates

Particulate matter (total suspended particulates) was sampled using General Metal Works high-volume (Hi-Vol) air samplers with volumetric flow controllers. The particulate sampling program was operated according to EPA guidelines as described in the *Quality Assurance Requirements for Prevention of Significant Deterioration*, 40 CFR, Part 50, Appendix B. Sample filters were analyzed by a gravimetric method using pre- and post-weights to determine total particulates. During each 1-hour sample run, 68 m³ of sample were collected. For the composite 3-hour sample, a total of 204 m³ of volume was sampled. With an analytical detection limit of 0.1 milligram (mg), the method detection was $0.5 \ \mu g/m^3$.

3.2.4.2 Volatile Organic Compounds

Volatile organics were sampled using passivated stainless-steel Summa[®] canisters, which were analyzed by gas chromatography/mass spectrometry (GC/MS) per EPA Method TO-14.

A Summa® canister is a stainless-steel vessel that has had its internal surfaces specially passivated using a "Summa" process. This process combines an electropolishing step with chemical inert. A Summa surface has the appearance of a bright and shiny mirror. A sample enters the canister through a high-temperature, stainless-steel bellows valve. A Summa canister will hold a high vacuum (<1 m Torr: <28 inches Hg) for up to 30 days. After 30 days, it is necessary to evacuate the canister prior to use to ensure that it is free of contaminants.

Canisters are cleaned using a combination of exponential dilution, heat, and high vacuum. They are generally batch-certified (1 in 10) by filling them with ultra-high-purity

air, which is subsequently analyzed using either GC/MS (TO-14) or GC/ flame ionization detection (FID) (TO-12). If the target analyte concentrations are below 0.2 part per billion by volume (ppbv) (TO-14) or if the total hydrocarbon level is less than 0.2 ppbv, the batch of canisters is considered "clean" and is certified for use.

Although 14 days is the most commonly cited holding time for a canister sample, the holding time is somewhat analyte-specific. For example, nonpolar analytes such as chloroform, benzene, and vinyl chloride are stable in a canister for at least 30 days. However, polar analytes such as methanol and acetone often will condense on the canister walls (the degree of which is a function of the sample humidity). Analysis of these samples should be performed within 72 hours.

The passivated canister sampling used pre-set flow controller devices to regulate the sampling flow rate into the canister. The flow controllers allowed an integrated sample to be collected without the canister achieving an equilibrium ambient pressure. Sampling was conducted using an evacuated 6 liter Summa canister. The flow into the canister was controlled by an orifice to allow approximately 1.5 liters of sample to be collected during each 1-hour sample run for a total of 4.5 liters per three runs.

Table 3-3 lists the VOCs that were analyzed for in each sample.

3.2.4.3 Carbon Monoxide and Nitrogen Oxides

Sampling was performed using a continuous emissions monitoring system (CEM) for oxygen and carbon dioxide (EPA Method 3A), carbon monoxide (EPA Method 10), and nitrogen oxides (EPA Method 7E). Due to the expected low concentration of CO₂ in the exhaust stream at the slipsteam, an ambient CO₂ monitor was used at the exhaust. The ambient analyzer had the ability to measure the concentration in several ranges: 0-1,000 ppm, 0-1% and 0-5% CO₂.

TABLE 3-3. SUMMARY OF AMBIENT TARGET COMPOUNDS FOR VOLATILE ORGANIC COMPOUNDS

Volatile Organic Com	pounds – EPA Method TO-14 List
Freon 12	m,p-Xylene ,
Freon 114	o-Xylene
Chloromethane	Styrene
Vinyl Chloride	1,1,2,2-Tetrachloroethane
Bromomethane	1,3,5-Trimethylbenzene
Chloroethane	1,2,4-Trimethylbenzene
Freon 11	1,3-Dichlorobenzene
1,1-Dichloroethene	1,4-Dichlorobenzene
Freon 113	Chlorotoluene
Methylene Chloride	1,2-Dichlorobenzene
1,1-Dichloroethane	1,2,4-Trichlorobenzene
cis-1,2-Dichloroethene	Hexachlorobutadiene
Chloroform	Methanol
1,1,1-Trichloroethane	Ethanol
Carbon Tetrachloride	Isopropanol
Benzene	Acrolein
1,2-Dichloroethane	Acetone
Frichloroethene	Acetonitrile
,2-Dichloropropane	Acrylonitrile
cis-1,3-Dichloropropene	Vinyl Acetate
Toluene	Tetrahydrofuran
rans-1,3-Dichloropropene	1,4-Dioxane
1,1,2-Trichloroethane	Ethyl Acetate
etrachloroethene	2-Butanone
Ethylene Dibromide	Methyl Methacrylate
Chlorobenzene	4-Methyl-2-Pentanone
Ethyl Benzene	

3.3 ENGINE TEST CYCLE DATA

In order to correlate the aircraft engine emissions data with the engine operation, facility personnel compiled selected engine test cycle data during testing. The engine test monitoring system at this test stand constantly monitored a variety of engine parameters during engine testing. For the purpose of emissions sampling, a select number of these parameters were provided to the SPO for emission factor development. These parameters assisted in noting the effect of a specific pollutant for a specific engine load condition. The following data (or equivalent) was compiled and retained by facility personnel:

- Fuel flow at each load (primary and afterburner fuel flow).
- · Engine rpm at each load.
- Thrust at each load.
- Engine pressure ratio (EPR).
- Humidity and temperature.

Please note that fuel flow and engine thrust were the most important data items in the above list. The remaining data were important for documentation of engine conditions during sample collection. Due to security issues, EQ was not involved in the collection or review of any engine operating data. This was controlled by LMAS and the SPO.

3.4 JP-8 FUEL SAMPLING AND ANALYSIS

The proximate/ultimate JP-8 fuel analysis and level of nitrogen was determined for the facility in order to verify fuel characteristics during testing. Table 3-4 lists a portion of the fuel analysis that was performed by the facility. During the testing period, EQ collected two fuel samples for metals analysis.

TABLE 3-4. JP-8 FUEL ANALYSIS REQUIREMENTS

Parameter	Analytical Method
Trace Sulfur	ASTM D-2622
Carbon, Hydrogen, and Oxygen	ASTM D-5291
Trace Nitrogen	ASTM 4629 (chemiluminescence)
Heating Value (Net and Gross)	ASTM D-240
Density	ASTM D-1480
API Gravity/Density	ASTM D-1298

3.5 ENGINE TESTING MATRIX

3.5.1 Engine Shakedown Runs

Prior to the commencement of emission testing, a preliminary set of gaseous emission and exhaust flow data was determined at each setting. The purpose of the shakedown runs was to determine the expected gaseous pollutant concentrations so that the appropriate calibration gases could be determined. Also, the preliminary flow measurements were used to select the proper sample nozzle diameter.

During the shakedown runs, several measurements were made at multiple idle settings and at several settings that were not planned for the complete test program. The fuel flow was adjusted at small increments, and gaseous emissions were measured at the slipstream rake to note the variance in emissions as fuel flow increased. This provided gaseous emissions data.

3.5.2 Engine Testing

Emissions testing was performed on the F119-PW-100 engine at five power settings. These power settings are the following:

- Idle, 10% power
- Approach, 20% power
- Intermediate, 70% power

- Military, 100% power
- Maximum afterburner, 150% power

Emissions testing was comprised of three 1-hour emissions tests for each pollutant at the idle and approach power settings. Two 1-hour tests were completed at the intermediate and military settings. An oil leak occurred during testing at the intermediate setting, thereby limiting available testing time. The engine had to be allowed to cool and investigated prior to any further testing. The limited testing time did not allow for a third test at intermediate. At the military setting, the engine could be operated continuously for approximately 35 minutes before being shut down for refueling. Due to time constraints for refueling, only two runs were conducted at military; a single 10-minute run for gaseous pollutants only was performed at afterburner. Sample time at afterburner was limited due to fuel constraints and the need to limit engine run time at afterburner.

In addition, a 30-minute sample was collected from the engine rake at the idle and approach settings. At each setting, a sample was collected for approximately 15 minutes at the beginning of the test run; the rake was turned over to the University of Missouri test team who were gathering research data, then sampled again for approximately 15 minutes at the end of the test run.

Due to sample volume and method detection limit requirements, the aldehyde/ketone sample was composited over the 3-hour period. The other particulate matter and volatile samples ran for 1 hour. The engine had to be brought down to a safe operating level so that the test team personnel could access sampling equipment for approximately 10 minutes in between each sample run. All engine settings were defined by Pratt & Whitney so that the engine could be run continuously (or as long as practical) at idle, approach, intermediate, military and afterburner. EQ adjusted the sample collection procedure to accommodate the reduced operating time at the afterburner setting. Ambient air sampling was conducted only during emissions testing. Ambient samples were composited for each of the three 1-hour test runs at that power

setting. Table 3-5 lists engine type, number of power settings, and number and types of samples that were collected.

3.5.3 Engine Emission Trend Development

In addition to the settings listed in Table 3-5, an additional sample run from idle to military was conducted. The purpose of the run was to sample for gaseous pollutants throughout the engine power band. The engine throttle position was increased in small increments at approximately 10-minute intervals so that gaseous emission data could be collected at the slipstream rake to develop an emission trend for the engine.

3.6 EMISSION TEST SCHEDULE

Figure 3-1 shows the general time-line for engine testing at the LMAS facility. The time-lines depict activities and the time each activity required for equipment setup, shakedown runs, emissions testing, and demobilization at the test facility.

The following is a breakout of the general tasks conducted during each of the three phases:

- Equipment setup Setup and calibration of sampling equipment was completed over 5 days (September 5 through September 10). This involved setting up the exhaust rake and slipstream sampling systems, sampling equipment, tracer gas systems, the flow measurement system, and the mobile laboratory. EQ set-up equipment outside the test stand while other testing was being conducted and the sound exposure was insignificant. There were times when test team personnel needed to enter the test exhaust tube. During this time the test cell was dedicated to equipment setup activities and remained inactive.
- Shakedown During this important period, both the test team and engine test stand operators became familiar with the operational procedures of the test program. The test team gathered preliminary information at each of the engine test settings. This information was vital to ensure that the scheduled test runs were conducted accurately and efficiently. The Shakedown runs were completed on September 11.

Revision 1 June 2002 Page 19 of 22 Test Report Section 3

TABLE 3-5. ENGINE EMISSION SAMPLING MATRIX

Politizary Method Politizary Politizary			-	J. C. C.		ENGINE EMISSION SAMPLING MAI RIX			\				
Sample Silpstream			Sample	ocation							Poline Cotting		
X	tant/ Method	Engine Rake(B)		Silpstream	Ambient	Sample Duration (A)	Number of Samples	Total Number of Samples		Anoroach	e de la company	1	After-
X X	Method 5202			×		, 09	3,3,2,2	10	 	×	×	×	
X X	Particulate/Team Series 7000 (Real Time)			×		09	3,3,2,2	10	×	×	×	×	
X X	Aldehydes and Ketones/EPA Method 0011			×		180	-	4	×	×	×	×	
X X	VOST/EPA Method 0030			×		09	3,3,2,2	10	×	×	×	×	
X X K 60/30 3,3,2,2,1 11 X	Carbon Monoxide/EPA Method 10	×	×		×	60/30	3,3,2,2,1	£	×	×	×	×	×
X X	Carbon Dioxide and Oxygen/ EPA Method 3A	×	×		×	06/09	3,3,2,2,1	+	×	×	×	×	×
X X 60/30 3,3,2,2,1 11 X X X X X X X X 11 X	Oxides of Nitrogen/EPA Method 7E	×	×			90/30	3,3,2,2,1	1	×	×	×	×	×
X X X 11 X 180 1 5 X 180 1 5 X X X 180 1 5 1 5 1 5 1 5 1 5 1 5 1 5 1 5 1 1 <	Total Hydrocarbons/ EPA Method 25A	×	×		×	06/09	3,3,2,2,1		×	× .	×	×	×
x x x x x x x x x x x x x x x x x x x	Methane/EPA Method 25A	×	×			06/09	3,3,2,2,1	1-	×	×	×	×	×
X 180 1 5 X X	Particulate/40CFR Part 60, Appendix B				×	. 180	-	က	×	×	×	×	
	Volatile Organic Compounds				×	180	_	ç	×	×	×		

A – 30 minute samples were collected at the engine rake. A 10-minute sample was collected at afterburner. B – The engine rake was removed prior to sampling at intermediate.

Test Report Section 3 Revision 1 June 2002 Page 20 of 22

DAY	Σ	- n_	×	Th	F	Sa	Su	Σ	T.	3	Th	Щ
	9/04	9/04 9/05	90/6	20/6	80/6	60/6	9/10	9/11	9/12	9/13	9/14	9/15
	Z							SD				
Engine Trend Curve Idle – Intermediate								SD				
Intermediate												
Military & Afterburner												
Equipment Teardown												Δ



Figure 3-1. Time-Line for F119-PW-100 Engine Testing at the Lockheed Martin Aeronautical Systems (LMAS Facility)

- Testing Testing of the engine commenced on September 12. Three runs were completed at the idle and approach settings on this day. Testing at the intermediate setting was completed on September 13. Two runs were completed instead of three due to an oil leak in the engine, which contributed to downtime. The engine was tested at the military and afterburner settings on September 14. The engine could be operated for 35 minutes at military, but then had to be shut down to cool. In addition, after an hour of operation, refueling was required. Due to these time constraints and refueling needs, only two runs at military were completed. The afterburner test was limited to approximately 10 minutes due to fuel constraints and the attempt to limit engine time at afterburner.
- Teardown Teardown of the equipment was accomplished in 1 day, September 15.

3.6.1 Personnel Responsibilities

The nature of this test program dictated that the members of the sampling team be highly skilled. The program was staffed at the appropriate level with the necessary skill levels to perform each task. Each team member was actively involved in the collection of emissions samples, fuel samples, sample recovery, data reduction, and sample shipment. Table 3-6 lists the personnel categories and the required qualifications and tasks. The test team functioned as an integrated unit to complete the test program efficiently and without compromising data quality or hush house utilization.

Test Report Section 3 Revision 1 June 2002 Page 22 of 22

TABLE 3-6. EXAMPLE BREAKOUT OF FIELD TEAM PERSONNEL AND RESPONSIBILITIES

Personnel	Responsibilities/Qualifications
EQ Project Manager	Acted as liaison between LMAS personnel, sample team, Pratt & Whitney and AFIERA/RSEQ. Coordinated engine operation with testing. Assisted in equipment preparation and sample recovery. Collected fuel samples. Set up and constructed sampling equipment.
Weston Team Leader	Assumed technical responsibility for overall sampling effort, sample recovery, and ambient air monitoring. Set up and calibrated equipment. Collected samples and operated FTIR system.
CEM Operator	Operated and calibrated CEM system, electronic flow measurement system, and tracer gas system.
VOST Sample Train Operator	Operated VOST sampling train and assisted other sampling personnel as needed.
Particulate Matter Train Operator	Operated particulate matter sampling train and assisted in sample recovery.
Aldehyde and Ketone Train Operator	Operated aldehyde and ketone sampling train; supervised IATA/DOT certification of shipment of hazardous materials (hazardous sample media, i.e., acetone); and acted as field sample custodian.
Sampling Technician	Provided sampling support to the above personnel.

SECTION 4

CALCULATION OF AIRFLOW

The calculation of emission rates for this test program required accurate measurement of both inlet (ambient) airflow as well as total exhaust flow (combustion products plus excess air). The total exhaust flow was required to quantify mass emission rates for the parameters being measured. The inlet airflow was required to quantify mass rates of any parameter that was measured in the ambient sampling program so that mass rate could be subtracted from the engine emission rate.

Whenever possible, standard EPA flow measurement methods were used to quantify airflow. However, the test location did not provide adequate measurement locations for traditional flow measurements. The following three alternate flow measurement techniques were employed at the location:

- Tracer gas concentration for total exhaust flow.
- Carbon balance for the calculation of inlet and total exhaust flow.
- F-factor for the calculation of inlet and total exhaust flow.

Each method has advantages and disadvantages that vary in significance depending on the specific conditions of each test run. The objective of the test program was to ensure that at least two independent techniques for measuring airflow were available for each test run.

4.1 CALCULATION OF EXHAUST AIRFLOW USING TRACER GAS

4.1.1 Tracer Gas Methodology

Because exhaust flow could not be measured at this location using standard EPA methods, tracer gases were used. The amount of dilution that occurred was determined by inputting a known amount of tracer gas into the exhaust stream and measuring a

concentration at the outlet. The dilution rate was then used to calculate exhaust flow rates. This Section details these calculations.

Tracer gas was released from the outside of the hush house at the inlet air screen into the exhaust stream through the ambient air intakes on either side of the hush house.

The tracer gas release points were monitored for temperature. It was important to monitor for temperature since SF₆ is stable up to 500 °F before it degrades. The tracer gas injection apparatus included thermocouples to determine temperatures at the injection point. The 500 °F threshold was very conservative because SF₆ will not decompose until 932 °F. However, EQ intended to maintain the conservative threshold as the point where the tracer method was more seriously examined because of the more extreme conditions that were present in the exhaust stream. Based on test stand operation information gained during site visits conducted prior to testing, it was likely that the temperature in the silencer tube at the tracer release point would exceed 500 °F in intermediate and afterburner modes. However, the temperature limit was not exceeded during testing. Therefore, the alternate methods discussed in Sections 4.2 and 4.3 were completed for comparative purposes.

The tracer gas was released opposite the flow to prevent the exhaust gas pressure from impacting the tracer gas release tubes and possibly affecting tracer gas distribution. Tracer gas was introduced into the stainless steel tubes via a mass flow controller calibrated to SF₆. The gas flowed into adjustable flow meters that regulated equal amounts of tracer gas into each of the tracer release tubes. Temperature was measured by a Type K thermocouple and recorded by a data logger.

Tracer gas was collected from the same location as the gaseous samples at the slipstream rake (Figure 2-9) in conjunction with each sample run. During the manual sample run, the tracer gas pickup points pulled a sample of exhaust that was analyzed to determine SF_6 concentration. A heated sample line carried the SF_6 directly to the analyzer where it was measured.

Test Report Section 4 Revision 1 June 2002 Page 3 of 12

The tracer gas flow methodology was not used to determine flow at the engine rake. Due to the proximity of the engine rake to the engine, the tracer gas did not have adequate time to mix with the engine exhaust.

This sample location had a single well-defined exhaust augmentor tube but due to its configuration it was difficult to measure by EPA Reference Methods. The exhaust flow was instead calculated from tracer gas dilution ratios. In the tracer gas flow measurement technique, a precise mass flow of the sulfur hexafluoride tracer gas (SF₆) was injected into the exhaust stream after the engine. The SF₆ was injected through four points to obtain good dispersion into the exhaust gas stream. An integrated sample collected at each sampling point at the exhaust location was analyzed for SF₆.

The tracer gas flow calculation is based on the assumption that the SF_6 was dispersed uniformly throughout the exhaust gas. If this assumption is valid, then the following determination is valid simply by mass balance.

$$S_m = Q_s \times C_s \times K$$

Where:

 C_s = Average concentration of SF_6 in the exhaust gas. K = Physical constants required to attain consistent units.

Since the SF₆ was distributed uniformly, then the concentration in any sample was equal to the average concentration; thus, by substitution and rearrangement, the following calculation was derived:

$$Q_s \frac{m^3}{min} = \frac{1.64795 \times 10^5 \text{ Sm}}{C_f}$$

Where:

1.6745 x 10³ = Conversion constants times standard molar volume divided by molecular weight of SF₆
$$\left[\left(\frac{24.05 \times 10^{-3} \text{ m}^3}{\text{gm - mole}} \right) x \left(\frac{\text{gm - mole}}{146 \text{ gm}} \right) x \left(\frac{10^{-3} \text{ g}}{\text{mg}} \right) x \left(\frac{\text{ppb}}{1 \times 10^{-9}} \right) \right]$$

Test Report Section 4 Revision 1 June 2002 Page 4 of 12

with units of
$$\frac{m^3 - ppb}{mg}$$

Q_s = Total exhaust flow, cubic meters per minute (m³/min), wet basis.

Sm = Metered injection of SF₆, milligrams per minute (mg/min).

 C_f = Concentration of SF_6 in sample, parts per billion (ppb).

The flow rate calculation was presented on a metric basis for clarity. All flow rates and emissions were presented in both English and metric units.

The assumption of uniform concentration of the tracer gas is not self-evident in this system and must be proven for each operating condition. The following subsections describe the steps required to prove the assumption, and use of the results to correct other measurements.

4.1.2 Sampling for SF₆ and Determining a Homogeneous Exhaust Mixture

It is not practical to sample the entire engine exhaust to show that the exhaust is homogeneous throughout. Twelve points at the slipstream rake (Figure 2-9) in the exhaust cross section were sampled. Sampling was conducted at each of those points at various engine settings to document that the exhaust stream remained well mixed under several flow scenarios.

4.1.3 Determination of Average SF₆ Concentration

The dilution flow measurement technique requires a well mixed exhaust stream. Simultaneous samples were taken at points in the augmentor tube for all engine operating conditions. The results of the sample analysis were used to calculate an average concentration. A statistical analysis of the data points around this sample average were used to validate this average using the Student's t distribution at a 95% confidence interval. If the sample average satisfied this criterion, the sample average was equal to the true average within the range of the confidence interval for 95 % of all measurements. The range for this evaluation was set at twice the limit of detection (LOD) for the sample analysis.

Test Report Section 4 Revision 1 June 2002 Page 5 of 12

The SF_6 was injected at a rate sufficient to generate a 20-ppb concentration in the well mixed exhaust stream. The LOD for the SF_6 analysis was 0.5 ppb.

4.1.4 Evaluation of Average SF₆ Concentration

After the statistical analysis was completed, the following decision tree was employed:

If the permanent sample point average SF_6 concentrations satisfied the statistical criterion, then the gas stream was well mixed and the average SF_6 concentration measured at the permanent sample points were used to calculate flow rate.

If the sample average SF₆ concentration did not satisfy the statistical criterion, the number of SF₆ injection points were doubled to increase dispersion.

The test program continued on schedule (no further shakedown runs), but the tracer-gas-flow calculation was valid only for those subsequent test runs that met the statistical requirements.

4.1.5 Use of SF₆ Concentration to Adjust Other Sample Results

For those test concentrations where the permanent sampling point average SF₆ concentrations satisfied the statistical criterion, the ratio of the individual permanent sample point concentration to the valid run average was used to determine a corrected average emission rate for that sample.

4.2 CALCULATION OF INLET AND OUTLET AIRFLOW USING A CARBON BALANCE

This method calculates both inlet and outlet airflow rates using a carbon mass balance. This method was used to determine airflow at both the engine exhaust and the total exhaust flow from the hush house. Conservation of matter requires that the total carbon mass rate in the exhaust (MCE) equals the sum of the total carbon mass rate in the fuel (MCF) and the carbon mass rate in the inlet air (MCI).

Test Report Section 4 Revision 1 June 2002 Page 6 of 12

A similar conservation of total mass states that the total mass rate in the exhaust (ME) equals the total mass rate in the fuel (MF) plus the total mass rate at the inlet (MI).

$$ME = MF + MI$$

Equation 2

Finally, the mass rate of carbon also can be derived as the total mass rate at each location times the percent carbon by weight (% C_x) in each stream.

 $MCE = ME \times % C_e/100$

Equation 3

 $MCF = MF \times % C_f/100$

Equation 4

 $MCI = MI \times % C_i/100$

Equation 5

The percent carbon by weight was measured in all streams and the mass rate of fuel burned also was measured. This leaves four unknown variables, ME, MI, MCE, and MCI, and five independent equations.

To solve for inlet mass flow rate, substitute Equation 2 into Equation 3.

$$MCE = (MF \times \% C_e/100) + (MI \times \% C_e/100)$$

Then substitute that equation into Equation 1.

$$(MF \times % C_e/100) + (MI \times C_e/100) = MCF + MCI$$

Substitute Equations 4 and 5 to get:

$$(MF \times % C_e/100) + (MI \times % C_e/100) = (MF \times % C_f/100) + (MI \times % C_i/100)$$

Rearrange factors to get the inlet mass rate.

$$MI = MF \left(\frac{\% C_f - \% C_e}{100} \right) / \left(\frac{\% C_e - \% C_i}{100} \right)$$

By similar derivation, rearrange Equation 2, substitute into Equation 5, substitute the results into Equation 1, and then substitute Equations 3 and 4 to get the following:

Equation 2

Test Report Section 4 Revision 1 June 2002 Page 7 of 12

$$\begin{split} \text{MCI} &= (\text{ME x \% C}_i/100) - (\text{MF x \% C}_i/100) & \textit{Equation 5 using Equation 2} \\ \text{MCE} &= \text{MCF} + (\text{ME x \% C}_i/100) - (\text{MF x \% C}_i/100) & \textit{Equation 1 using Equation 5} \\ \left(\text{ME x } \frac{\% \, \text{C}_e}{100}\right) &= \left(\text{MF x } \frac{\% \, \text{C}_f}{100}\right) + \left(\text{ME x } \frac{\% \, \text{C}_i}{100}\right) - \left(\text{MF x } \frac{\% \, \text{C}_i}{100}\right) & \textit{Equations 3 and 4} \\ \text{ME} &= \text{MF} \left(\frac{\% \, \text{C}_f - \% \, \text{C}_i}{100}\right) \middle/ \left(\frac{\% \, \text{C}_e - \% \, \text{C}_i}{100}\right) \end{split}$$

The mass emission rates can be converted to volumetric flow rates by dividing by molecular weight and multiplying by standard volume. For example:

$$QE = \frac{ME \times 385.35}{MW_e}$$

Where:

QE = Wet standard volumetric flow rate, $\frac{\text{wscf}}{\text{min}}$.

ME = Total exhaust flow rate, $\frac{\text{lb}}{\text{min}}$.

MW_e = Wet molecular weight exhaust stream, $\frac{\text{lb}}{\text{lb mole}}$.

385.35 = Standard molar volume, $\frac{\text{scf}}{\text{lb mole}}$.

The fuel mass rate was measured directly during each test run, and the % was determined by the fuel analysis.

The wet molecular weights of the exhaust gas streams were determined by EPA Reference Methods 3A and 4 (40 CFR 60). These methods measure the percent moisture (% M) of the gas stream and percent carbon dioxide (% CO₂) and oxygen (% O₂) in the gas stream on a dry basis, which were used to calculate the molecular weight as follows:

$$MW_{e} = \left[\left\{ \left(\% CO_{2} \times 0.48 \right) + \left(\% O_{2} \times 0.32 \right) + \left(\left(\% CO + \% N_{2} \right) * 0.28 \right) \right\} * \left(1 - \frac{\% M}{100} \right) \right] + \left(\% M \times 0.18 \right)$$

Where:

% M = Moisture content as a percent.

For the purpose of calculating a molecular weight, (% CO + % N_2) was assumed to be (1 - % CO₂ - % O₂). Calculation of the carbon content of the exhaust gas stream used the %CO₂ as determined by Method 3A, plus additional measurements of carbon monoxide (% CO) and total hydrocarbons (% THC) by EPA Reference Methods 10 and 25A (40 CFR 60, Appendix A). The % THC was stated on the basis of methane (CH₄). The carbon monoxide (CO) and carbon dioxide (CO₂) concentrations were measured on a dry basis and converted to a wet basis using the measured moisture content of the exhaust gas. THC was measured on a wet basis.

% CO₂ (wet) = % CO₂ (dry)
$$x \left(1 - \frac{\% M}{100} \right)$$

% CO (wet) = % CO (dry) $x \left(1 - \frac{\% M}{100} \right)$

The total carbon content of the exhaust gas stream is equal to the sum of % CO₂, % CO, and % THC on a wet basis times the ratio of carbon molecular weight to the total wet molecular weight of the gas stream.

%
$$C_e$$
 = (% CO_2 wet + % CO wet + % THC) x $\frac{12.01}{MW_e}$

A similar calculation was required for the inlet air volumetric flow rate, but the following simplifying assumptions were made:

- Dry ambient air is composed of 20.9% oxygen and 79.1% nitrogen.
- · Ambient humidity represents the moisture content of the inlet air.

Test Report Section 4 Revision 1 June 2002 Page 9 of 12

The major drawback to this measurement method was the use of extremely low carbon concentration values at the inlet, and relatively low concentrations at the exhaust to modify the very high carbon concentrations in the fuel. As excess air increases, the inlet flow was indistinguishable from the outlet flow. The major advantage of this procedure was that the only additional data that are required to calculate flow are: the inlet flow; CO, CO₂, and THC values; and ambient humidity.

4.3 CALCULATION OF AIRFLOW USING F-FACTORS

F-factors relate the volume of combustion products to the heat content of fuel.

F-factors generally are used for combustion sources when the exhaust stream flow rate is known but the fuel heat input must be determined. In this case, the fuel input was determined easily but the volumetric flow of combustion air was difficult to determine. The F-factor relationship was used to calculate the total exhaust flow at the engine rake and at the hush house exhaust based on a fuel firing rate.

F-factors are published for a variety of fuels and usually are expressed in units of dry standard cubic feet per British thermal unit (dscf/Btu or dscm)/joule (J). For this test program, specific F-factors were determined through historic ultimate analysis of the fuel components on a weight percent basis and fuel density.

 Ultimate analysis of jet fuel (i.e., hydrogen, carbon, sulfur, nitrogen, oxygen, and density (pounds per gallon [lb/gal]) on a mass basis (% wt).

To determine the air volumetric flow rate, the following additional information was required:

- The concentrations of oxygen, carbon monoxide, and moisture content in the exhaust stream after combustion.
- Fuel firing rate, gallons per minute (gal/min).

The F-factor, dry basis, was calculated from the ultimate analysis of the jet fuel as follows:

$$F_d = K[(K_{hd} \% H) + (K_c \% C) + (K_s \% S) + (K_n \% N) - (K_o \% O)]/GCV$$

(Equation 19-13, 40 CFR 60, Appendix A, Method 19)

If the heat input components (K, GCV) were eliminated from the equation, an Ffactor based on fuel mass was derived.

$$F_{md} = [(K_{hd} \% H) + (K_c \% C) + (K_s \% S) + (K_n \% N) - (K_o \% O)]$$

Where:

F_d = Volume of combustion components per unit of heat content, scf/million Btu. F_{md} = Volume of combustion component on a dry basis per pound of fuel, scf/lb. % H, % C, % S, % N, % O = Weight percents of hydrogen, carbon, sulfur, nitrogen, and oxygen in the jet fuel.

GCV = Gross calorific value of the fuel consistent with the ultimate analysis, Btu/lb.

 $K = Conversion factor, 10^{-5}$.

 $K_{hd} = 3.64 (scf/lb)/(%).$

 $K_c = 1.53 (scf/lb)/(%)$.

 $K_s = 0.53 (scf/lb)/(\%)$.

 $K_n = 0.14 (scf/lb)/(%)$.

 $K_0 = 0.46 (scf/lb)/(\%)$.

Stoichiometric combustion calculations assume that the carbon in the fuel is burned completely to produce carbon dioxide and water with no excess air (and no significant formation of nitrogen dioxide or carbon monoxide). The air stoichiometric volumetric flow rate (dry basis) was determined by simply multiplying the measured fuel firing rate by the F-factors.

(Fuel firing rate,
$$\frac{\text{gal}}{\text{min}}$$
) (fuel density, $\frac{\text{lb}}{\text{gal}}$) (F_{md} , $\frac{\text{scf}}{\text{lb}}$)

= dry combustion air flow, $\frac{\text{scf}}{\text{min}}$

The percent excess air (EA) during actual combustion was calculated using the following formula:

% EA =
$$\left[\frac{\% O_2 - 0.5\% CO}{20.9 - (\% O_2 - 0.5\% CO)} \right] \times 100$$

Where:

% O_2 , % CO = Measured percents of oxygen, and carbon monoxide, in the exhaust gas. 20.9 is the percent dry oxygen in ambient air.

Total dry combustion flow (including) excess air equals:

Total dry air flow =
$$\left[(dry combustion air flow) \left(1 + \frac{\% EA}{100} \right) \right]$$

This simplifies to:

Total dry combustion flow,
$$\frac{\text{scf}}{\text{min}} = (\text{dry combustion air})$$

$$* \left(\frac{20.9}{20.9 - \% O_2 + 0.5 \% CO} \right)$$

The inlet airflow is equal to the total dry combustion air plus the fraction of oxygen in the inlet used for the combustion of hydrogen in the fuel. The nitrogen associated with this oxygen fraction of the inlet air was included in the F_d calculation.

This inlet oxygen fraction can be derived from the same F-factor calculations presented in EPA Method 19.

$$F_{mo} = K [K_{hi} \% H]$$

Where:

 F_{mo} = Volume of inlet oxygen used to combust hydrogen per unit of fuel fired, scf/lb.

 $K_{hi} = 0.96 (scf/lb)/\%$.

% H = Weight percent of hydrogen in the fuel as stated previously.

Then the total dry inlet airflow is the following:

Dry inlet air =
$$\left[\text{fuel firing rate, } \frac{\text{gal.}}{\text{min}}\right] \left[\text{fuel density, } \frac{\text{lb}}{\text{gal.}}\right] \left[F_{\text{md}} + F_{\text{mo}}\right] * \left[\frac{20.9}{20.9 - \% O_2 + 0.5 \% CO}\right]$$

The inlet air then can be corrected back to actual conditions using the ambient temperature and humidity. The total exhaust flow can be adjusted to actual conditions using the measured exhaust moisture content and temperature.

There are limitations to the use of these F-factors for calculations of airflow from jet engines. The concentration of carbon monoxide in the combustion stream normally is so low that it is insignificant in the excess air calculation, but it has been included to cover operation during periods of incomplete combustion. If the combustion is so incomplete that large quantities of the fuel are exhausted as carbon (soot) or volatile hydrocarbons (THC), the % C of the fuel must be reduced to account for the reduced formation of combustion products.

The second limitation arises when high levels of excess air are present. At high excess air levels, the carbon monoxide concentration becomes zero, but the oxygen content of the combustion gas approaches ambient concentrations (20.9 % O₂). The excess air equation becomes unreliable at a concentration of 20.9 % oxygen as this equation is undefined due to division by zero. As a general rule, these F-factor calculations will be unreliable any time the combustion gas contains more than 18.5 % oxygen.

SECTION 5

QUALITY ASSURANCE PROCEDURES

5.1 QUALITY CONTROL PROCEDURES

As part of the engine testing program, EQ implemented a quality assurance (QA) and quality control (QC) program. QA/QC were defined as follows:

- Quality Control The overall system of activities whose purpose was to provide a quality product or service (e.g., the routine application of procedures for obtaining prescribed standards of performance in the monitoring and measurement process).
- Quality Assurance A system of activities whose purpose was to provide assurance that the overall QC was being conducted effectively.

The Field Team Leaders for stack sampling were responsible for implementation of field QA/QC procedures. Individual laboratory managers were responsible for implementation of analytical QA/QC procedures. The overall Project Manager oversaw all QA/QC procedures to ensure that sampling and analyses met the QA/QC requirements and that accurate data results from the test program were obtained.

5.1.1 Field QC Sample Collection/Preparation Procedures

Table 5-1 provides a summary of the numbers and types of field and analytical QA/QC samples by parameter. General field QC procedures were the following:

- Collect only the number of samples needed to represent the media being sampled.
- To the extent possible, the quantities and types of samples and sample locations were determined prior to the actual field work.
- As few people as possible handled the samples.

June 2002 Page 2 of 20 Test Report Revision 1 Section 5

TABLE 5-1. SUMMARY OF ANALYTICAL QA/QC SAMPLES

	DADAMETED				
SAMPLE	TAKAMETEK	NUMBER OF SAMPLES	IYPES OF QA/QC SAMPLES	QC SAMPLES	
			FB	TB	MS
EXHAUST SAMPLES ⁽¹⁾ :	;(1);			05500	
	Particulate	48	-		
	Volatile organics ⁽²⁾	48	1 pair	1 pair	12 pair
	Aldehydes and	4	_		
	Ketones				
AMBIENT (BACKGROUND)	(GNNC				
	Particulate	4	7		
r	Volatile organics	2		ı	•
() + (i)					

(1) Trip blanks for exhaust samples consisted of reagent blanks. See Subsection 5.1.2 for a

description of exhaust blank samples.
(2) Four VOST tubes per test run.
FB = Field Blank
TB = Trip Blank
MB = Method Blank or Preparation Blank
MS = Matrix Spike

Test Report Section 5 Revision 1 June 2002 Page 3 of 20

- The field sampler was personally responsible for the care and control of the samples collected until they were property transferred or dispatched.
- Sample records were completed for each sample, using black waterproof ink
 or other measures to ensure the legibility and integrity of sample
 identification.
- The Field Team Leader ensured that proper preservation, storage, and security procedures were followed during the field work and decided if additional samples were needed.
- Storage conditions of samples were documented on the sample forms or project records.

5.1.1.1 QC Procedures for Stack Gas Sample Collection

This subsection provides a list of QC procedures employed during the field sampling effort. Method-specific QC procedures are detailed in the method descriptions contained in Appendix A. General QC checks that apply to all methods include the following:

- Leak checks.
- Use of standardized forms, labels, and checklists.
- Ensure sample traceability.
- Collection of appropriate blanks.
- Use of calibrated instrumentation.
- Use of Protocol 1 and/or NIST-traceable calibration gases.
- Review of data sheets in the field to verify completeness.
- Use of validated spreadsheets for calculating results.

5.1.1.2 Velocity/Volumetric Flow Rate QC Procedures

Volumetric flow rates were determined during the isokinetic stack gas tests. The following QC procedures were followed during these tests:

- The S-type pitot tube was inspected visually before sampling.
- Both legs of the pitot tube were leak-checked before sampling.
- Proper orientation of the S-type pitot tube was maintained while making measurements. The yaw and pitch axes of the S-type pitot tube were maintained at 90° to the flow.

- The manometer oil was leveled and zeroed before each run.
- Cyclonic or turbulent flow checks were performed prior to testing the source.
- Pitot tube coefficients were determined based on physical measurement techniques as delineated in EPA Method 2.

5.1.1.3 Moisture Content and Sample Volume QC Procedures

Gas stream moisture was determined by EPA Method 4 as part of the isokinetic stack gas tests. The following QC procedures were followed in determining the volume of moisture collected:

- The balance zero was checked and rezeroed if necessary before each weighing.
- The balance was leveled and placed in a clean, motionless environment for weighings.
- The indicating silica gel was fresh for each run and was inspected periodically and replaced during runs, if needed.

The QC procedures that were followed to ensure accurate sample gas volume determination were the following:

- The dry gas meter was fully calibrated annually using an EPA-approved intermediate standard device.
- Pretest, port-change, and posttest leakchecks were completed (must be less than 0.02 cfm or 4 % of the average sample rate).
- The gas meter was read to the thousandth of a cubic foot for all initial and final readings.
- Readings of the dry gas meter, meter orifice pressure (Delta H), and meter temperatures were taken at every sampling point.
- Accurate barometric pressures were recorded at least once per day.
- Pre- and posttest program dry gas meter checks were completed to verify the accuracy of the meter calibration constant (Y).

Test Report Section 5 Revision 1 June 2002 Page 5 of 20

The most critical operating parameter for ambient air-sampling equipment was the airflow rate during sampling, which determines the total volume of air sampled. Calibrations of the ambient air-sampling equipment were performed to accurately determine the operating flow rates of the samplers, and to verify that all method-based flow-rate requirements were met.

All ambient air samplers were calibrated upon installation to establish the means for determining operating flow rates, and as required throughout the monitoring program whenever field calibration checks or repairs required recalibration. All calibrations were conducted according to standard operating procedures (SOP), using materials traceable to NIST reference materials. Calibrations were conducted by qualified personnel thoroughly familiar with the sampling equipment. All calibration and audit results were recorded in a field logbook and/or the calibration/audit data sheets. Other specific QA/QC for particulate, VOST, aldehydes and ketones, and CEMS are included in Appendix B.

5.1.2 Exhaust Gas Blank Samples

Stack gas blank samples consisted primarily of reagent blanks collected in the on-site sample recovery area during the test program. Reagent blanks included solvents used to recover stack samples, absorbing solutions, filters, and resins (Tenax, Tenax/charcoal). All reagent blanks were collected by transferring directly from storage containers to sample jars, or labeling filters and resins as blank samples.

For the VOST Method 0030° sampling trains, additional blank samples were taken in the field according to the following procedures. Blank Tenax and Tenax/charcoal cartridges were taken to the sampling location and the end caps removed for a period of time equal to the time required to exchange one pair of VOST tubes on the VOST train. After this time period, the end caps were replaced on the blank tubes and these tubes were handled in a manner similar to the other VOST tube

⁴⁰ CFR 60 Appendix A

Test Report Section 5 Revision 1 June 2002 Page 6 of 20

A blank Method 0011* (aldehydes and ketones) sample train was taken to the stack sample location, leak checked, and then recovered in the same manner as the Method 0011* stack samples.

The sampling media may contain small amounts of the target compounds emitted from naturally occurring or anthropogenic emission sources. Contamination may be introduced to the sampling media during handling of the media in the laboratory, in the field, or during shipping. Blank samples were used to quantify these sources of contamination. A blank sample consisted of a complete set of sampling media (e.g., a PUF cartridge and a glass fiber filter, or a complete ADS sampling train) that has had no air drawn through it by the sampling equipment. Field blank samples were collected during the monitoring program.

The field blanks were used to identify contamination resulting from field sample handling procedures. A field blank was handled in the same manner as an actual sample, undergoing the same preparation, installation in the sampler module, and recovery procedures.

The following stack sample blank corrections were performed.

- Particulate Acetone and methylene chloride blank.
- VOST Field and trip blanks.
- Aldehydes and Ketones Reagent blanks.

5.2 SAMPLING CONTAINERS, PRESERVATIVES, AND VOLUME REQUIREMENTS

Table 5-2 lists the holding times, storage containers and preservation requirements used for routine storage and handling of samples.

5.3 DECONTAMINATION PROCEDURES

Stack-gas sampling equipment was precleaned following standard source test. method procedures. All stack-gas sampling equipment was cleaned on site as part of individual sample recovery procedures.

Page 7 of 20 **Test Report** Section 5 Revision 1 June 2002

TABLE 5-2. RECOMMENDED SAMPLE CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

SAMPLE LOCATION ANALYTE	ANALYTE	MATRIX	CONTAINER TYPE AND SIZE	PRESERVATION	HOLDING TIME
ENGINE EXHAUST	Particulate Condensable	Liquids, Filters,	AG/500 mL AG/1.0 L	AN AN	A N
	particulate	and resins	G/40 mL		14 days
	Volatile organics		AG/1L		14 days to exit/40 days to analysis
	Aldehydes and Ketones	Liquid	AG/1.0 L	≤4 °C	14 days
AMBIENT	Particulate	Filter	J	NA	NA
	Volatile organics	Whole air	S	AN A	30 days
		Filter/PUF	G/A	4 ± 2°C	7 days to exit/40 days
					to analysis

Key:

A= Aluminum Foil
AG = Amberglass
D = Denuder Tube
E = Envelope/Folder
G = Glass
NA = Not Applicable
P = Plastic
S = Stainless Steel Canister.

Test Report Section 5 Revision 1 June 2002 Page 8 of 20

Sample containers were purchased from a vendor with a certificate indicating that each lot of bottles was free of contaminants.

All personnel associated with sample collection used designated personal protective equipment (PPE). Personnel followed standard PPE decontamination procedures for each level of PPE required.

All personnel received the proper hazardous materials training as specified in 29 CFR 1910.

5.4 SAMPLING PACKAGING AND SHIPMENT

All samples were packaged and shipped according to the specifications detailed in the Hazardous Materials Transportation Regulations published by the U.S. Department of Transportation (DOT) (49 CFR 171-180) for ground transportation and the International Air of collection, shipment, laboratory receipt, and laboratory custody until disposal was documented to accomplish this objective. Documentation was accomplished through a chain-of-custody record that documents each sample and the individuals responsible for Transport Association (IATA) regulations for air shipment. These regulations contain detailed instructions on how hazardous materials must be identified, packaged, marked, labeled, documented, and placarded. All personnel involved with sample shipment were trained and certified for shipment of hazardous materials.

When transferring possession of samples, the individuals relinquishing and receiving those samples signed, dated, and noted the time on the sample chain-of-custody record. This record documents sample transfer from the sampler, often through another person or commercial carrier, to the sample custodian or analyst.

The procedure for shipping samples was as follows:

- A complete sample inventory form (chain-of-custody) was enclosed with the samples being shipped, and a copy retained by the Field Team Leader.
- DOT and IATA regulations were followed for shipping container requirements.
 The regulations require that the shipper make a reasonable determination
 whether the sample is classified as a hazardous material and, if so, that it is
 appropriately identified.

Test Report Section 5 Revision 1 June 2002 Page 9 of 20

- Each package was designed and constructed, and its contents limited, so that under normal transportation conditions there was no significant release of materials to the environment and no potentially hazardous conditions.
- Samples were placed inside a shipping container for transport back to the laboratory.
- Preservation of the samples (e.g., refrigerant packs, ice, chemical preservatives, etc.) was performed as required by the test plan or analytical requirements and documented on the sample inventory record.

All freight bills and shipping records were retained as part of the permanent records by the Project Manager.

5.5 CUSTODY PROCEDURES

An overriding consideration for environmental measurement data was the ability to demonstrate that samples have been obtained from the locations stated using the prescribed methods and that they have reached the laboratory without alteration. Evidence of collection, shipment, laboratory receipt, and laboratory custody until disposal was documented to accomplish this objective. Documentation was accomplished through a chain-of-custody record that documents each sample and the individuals responsible for sample collection, shipment, and receipt. A sample was considered "in custody" under the following conditions:

- It was in a person's actual possession.
- It was in view after being in physical possession.
- It was secured in a locked compartment so that no one could tamper with it after it had been in physical custody.
- It was in a secured area, restricted to authorized personnel.

5.5.1 Field Custody Procedures

Sample custody was initiated by EQ during collection of the samples. Preformatted labels were used at the time of collection. Documents prepared specifically for monitoring

Test Report Section 5 Revision 1 June 2002 Page 10 of 20

field sample collection and recovery were used for recording pertinent information about the types and numbers of samples collected and shipped for analysis. The samples collected first were assembled at an on-site location for batching and paperwork checks. This task included matching similar sample types (e.g., solids, liquids) from all sampling locations. Sample packaging procedures complied with all DOT and IATA requirements for shipment of environmental samples. Establishing or maintaining sample integrity involved numerous steps or considerations in addition to custody documentation. For example, major concerns in programs of this nature were contamination, cross-contamination, and/or degradation of sample containers; absorbing and filtration media; recovery materials; and actual samples, as applicable. These problems were avoided or minimized at all times by using the following procedure:

- The lid of each labeled jar was secured with a strip of custody tape.
- Individual sample jars were then sealed in plastic bags and placed in appropriate shipping containers.
- Volatile materials were stored, handled, and transported apart from sorbent materials (e.g., store, handle, and ship VOST tubes apart from solvents [methylene chloride, acetone, toluene, etc.] used to recover the other sample trains).
- Volatile, organic, and aldehyde and ketone samples were sealed and kept away
 from sources of solvents, gasoline, etc., during recovery, transportation, storage,
 and analysis (e.g., recovery of particulate samples where acetone is used was
 performed remote from preparation, recovery, and storage of VOST and
 aldehyde and ketone samples).
- Vermiculite was placed around the bags in the shipping container for protection from damage, if needed. Ice was placed in the shipping container, if required.
- One chain-of-custody form was completed for each shipping container, placed in a large plastic bag, and the bag taped to the inside lid of the shipping container.
- The container was taped closed with tape and sealed with custody tape on two sides such that opening the container broke the custody tape.

Collected samples were kept under lock and key or within sight at all times until their shipment to the laboratory. The field sampler acted as the sample custodian and the

Test Report Section 5 Revision 1 June 2002 Page 11 of 20

document control officer in order to monitor the location of collected samples and to record vital sample information in field logbooks.

A unique system for individual sample identification was used. Table 5-3 provides a legend of the identification system for stack gas samples and some examples. The identification code was included on each sample label.

A uniform sample identification system was used in the ambient air-monitoring program. All samples were identified using the following format:

Ussssss - mmddyy - ppp(n) - qq

Where

U Indicates United States Air Force;
ssssss Monitoring site designator:
Operation mode and engine type
(e.g., ATF101 - Approach, Tinker, F101-GE-102)

mm Sample month, two digits dd Sample day of month, two digits

yy Sample year, last two digits

ppp Pollutant/media identification code (two or three characters):

VOC - Volatile Organic Compounds PM - Particulate Matter

PAH - Polynuclear Aromatic Hydrocarbons

DNP - DNPH-coated annular denuder (aldehydes and ketones)

n Sequence number, only used for multimedia sampling trains

qq Quality assurance sample identifier (one or two characters):

FB - Field blank

For example, a sample identified as UP-110599-PM-FB indicates the first particulate matter filter field blank at Lockheed Martin, which ran on 05 November 1999.

This naming convention allows every sample to be completely and consistently identified on the field data sheets, sample media labels, chain-of-custody forms, and laboratory reports. The naming convention was designed to provide redundant

Test Report Section 5 Revision 1 June 2002 Page 12 of 20

TABLE 5-3. LEGEND FOR SAMPLE IDENTIFICATION SYSTEM

				SAM	SAMPLE TYPE STACK SAMPLES
PROJECT NAME	MODE	SAMPLE LOCATION	RUN NUMBER	METHOD	FRACTION
AF (United States Air Force)	l (idle)	PF119 (Pratt & Whitney F119-PW-100)	_	M5 (particulate)	FHA (front half acetone)
	A (approach)		2	M0030 (volatiles)	Filt (filter)
	N (intermediate)		3	M0011 (aldehydes and ketones)	BHW (back half water)
	M (military)		FB (field blank)		BH MeCl ₂ (back half MeCl ₂)
	B (after burner)		TB (trip blank)		FHS (front half solvent)
	01 (other power setting 1)		D (duplicate)		BHS (back half solvent)
	02 (other power setting 2)				TP (tube pair)
	03 (other power setting 3)				COND (VOST condensate)
					SB (stack blank)
					TB (trip blank)

EXAMPLES: AF-A-PF119-1-M5-FHA = United States Air Force, Approach, Pratt & Whitney, F119-PW-100, Run 1, Method 5, Front Half Acetone

Test Report Section 5 Revision 1 June 2002 Page 13 of 20

information that can be used in conjunction with laboratory media identification numbers to verify sample identity.

The final evidence file includes at a minimum the following:

- Field logbooks.
- · Field data and data deliverables.
- Photographs.
- Drawings.
- Laboratory data deliverables.
- Data validation reports.
- Data assessment reports.
- Progress reports, QA reports, interim project reports, etc.
- All custody documentation (i.e., tags, forms, airbills, etc.).

5.6 CALIBRATION PROCEDURES AND FREQUENCY

This subsection describes the calibration procedures and the frequency at which these procedures were performed for both field and laboratory instruments.

5.6.1 Field Instrument Calibration

The following equipment items were calibrated before and after field usage:

- Velocity measurement devices.
- Gas flow rate metering systems.
- Gas volume metering equipment.
- Gas composition measuring apparatus (Orsat).

The calibration records include device numbers, calibration dates, methods, and data and results, and are maintained on file at the Weston laboratory. Copies of applicable calibration records also were available at the job site for review.

Acceptance limits are shown for each equipment item in Table 5-4.

5.7 DATA REDUCTION, VALIDATION, AND REPORTING

Data was produced primarily from three sources, specifically the following:

 Engine operations during the test program (classified information that was gathered and retained by Pratt & Whitney).

Test Report Section 5 Revision 1 June 2002 Page 14 of 20

- Field measurements data, including sampling records (volumes and duration), and observations.
- Sample analysis and characterization data.

All data generated by field activities or by the laboratory was reduced and validated prior to reporting. Specific data reduction, validation and reporting procedures are described in the following subsections.

5.7.1 Data Reduction

5.7.1.1 Field Data Reduction Procedures

The stages of data confirmation began with an initial series of calculations completed

on the <u>same day</u> as the sampling effort to establish that the pretest assumptions were correct and that the test procedures completed to that point were performed in an acceptable manner. This enabled the on-site test team to correct any faulty procedures, and provided a greater understanding of immediate problems. The on-site data reduction and confirmation activities were performed by an experienced data management specialist.

5.7.1.2 Office Calculations

All data averages were "double-checked" to verify numerical accuracy by an experienced technician. Prior to utilization of the analytical data for calculation of test results, a check was applied to ascertain any obvious "out-of-line" results for reanalysis. All results of calculations were examined by another individual as assigned by the Field Team Leader. Depending on the complexity of the work, this person either spot-checked certain calculations or repeated the entire effort as assigned by the Field Team Leader. When all data was summarized, a check was made for test result correctness by the Field Team Leader and by the EQ Program Manager. The EQ or Weston QA Manager

Test Report Section 5 Revision 1 June 2002 Page 15 of 20

TABLE 5-4. ACTIVITY MATRIX FOR CALIBRATION OF EQUIPMENT^a

APPARATUS	ACCEPTANCE LIMITS	FREQUENCY AND METHOD OF MEASUREMENT	ACTION IF REQUIREMENTS WERE NOT MET
Wet test meter	Capacity 3.4 m ³ /hr (120 ft/hr); accuracy within ±1.0%	Calibrate initially, and then yearly by liquid displacement.	Adjust until specifications are met, or return to manufacturer.
Dry gas meter	$Y_1 = Y \pm 0.02 Y$	Calibrate vs. wet test meter initially, and when posttest check exceeds Y ±0.05 Y	Repair, or replace and then recalibrate.
Thermometers	Impinger thermometer ±1°C (2°F); dry gas meter thermometer ±3°C (5.4°F) over range; stack temperature sensor ±1.5% of absolute temperature	Calibrate each initially as a separate component against a mercury-in-glass thermometer. Then before each field trip compare each as part of the train with the mercury-in-glass thermometer.	Adjust to determine a constant correction factor, or reject.
Probe heating system	Capable of maintaining 120° ± 14°C (248° ± 25°F) at a flow rate of 20 l/min (0.71 ft³/ min)	Calibrate component initially by APTD-0576(11) if constructed by APTD-0581(10), or use published calibration curves.	Repair or replace and then reverify the calibration.
Barometer	±2.5 mm (0.1 in.) Hg of mercury-in-glass barometer	Calibrate initially vs. mercury-in- glass barometer; check before and after each field test.	Adjust to agree with a certified barometer.
Probe nozzle	Average of three ID measurements of nozzle; difference between high and low 0.1 mm (0.004 in.)	Use a micrometer to measure to nearest 0.025 mm (0.001 in.); check before field test.	Recalibrate, reshape, and sharpen when nozzle becomes nicked, dented, or corroded.
Type S pitot tube and/or probe assembly	All dimension specifications met, or calibrate according to Subsection 3.1.2, and mount in an interference-free manner	When purchased, use method in Subsections 3.1.1 and 3.1.2; visually inspect after each field test.	Do not use pitot tubes that do not meet face opening specifications; repair or replace as required.
Stack gas temperature measurement system	Capable of measuring within 1.5% of minimum absolute stack temperature	When purchased and after each field test, calibrate against ASTM thermometer.	Adjust to agree with Hg bulb thermometer, or construct a calibration curve to correct the readings.
Analytical balance	±1 mg of Class-S weights	Check with Class-S weights upon receipt.	Adjust or repair.

(continued)

Test Report Section 5 Revision 1 June 2002 Page 16 of 20

TABLE 5-4 (continued)

APPARATUS	ACCEPTANCE LIMITS	FREQUENCY AND METHOD OF MEASUREMENT	ACTION IF REQUIREMENTS WERE NOT MET
Differential pressure gauge (does not include inclined manometers)	Agree within ±5% of incline manometers	Initially and after each field use.	Adjust to agree with inclined manometer or construct calibration curve to correct the readings.
Orsat analyzer	Average of three replicates should be 20.9 ± 0.5% (absolute) or known concentration ±0.5 (absolute)	Upon receipt and before any test in which the analyzer has not been checked during the previous 3 mo; determine % O ₂ in ambient air, or use a calibration gas with known CO, CO ₂ , and O ₂ concentrations	Check Orsat analyzer for leaking valves, spent absorbing reagent, and/or operator techniques. Repair or replace parts or absorbing solutions, and/or modify operator techniques.
Rotameter or rate meter	Smooth curve of rotameter actual flow rates with no evidence of error. ±5% of known flow rate.	Check with wet test meter or volume meter at 6-month intervals or at indication of erratic behavior.	Repeat calibration steps until limits were attained.

EPA-600/9-76-005, Quality Assurance Handbook for Air Pollution Measurement Systems - Volume III,
 U. S. EPA, Office of Research and Development, Environmental Monitoring and Support Laboratory,
 Research Triangle Park, NC, January 1976, as revised.

Test Report Section 5 Revision 1 June 2002 Page 17 of 20

conducted routine audits to document that the checks were being performed and documented (with checker's initials and date).

The initial field test data and resulting calculations were performed on a portable PC at the end of each test day. In the office, final results and result tables were developed on a microcomputer. Standard EPA method programs have been developed and validated for the computational systems to ensure that correct equations were utilized to generate results. The programs list all entry items (for proofing purposes) and produce calculated results in hard copy form. Reference method equations were used to calculate the concentration and/or mass rate of each measured parameter.

5.7.2 Analytical Data Validation Evaluation

All data was compared to the acceptance criteria of the reference method. For example, particulate tests must be 100% isokinetic, ±10%, to be acceptable. Laboratory data was acceptable only if calibration standards fell within the established control limits.

Outliers were treated on a case-by-case basis. All questionable data were reviewed in an attempt to find a reason for rejection.

Analytical data was appropriately qualified in the scientific and technical report.

Case narratives were prepared, which include information concerning data that fell outside acceptance limits, and any other anomalous conditions encountered during sample analysis. After the Laboratory QA Officer approved these data, they were considered ready for data validation.

5.7.2.1 Procedures Used To Evaluate Field Data

Procedures used to evaluate field data included posttest field instrument calibration checks, acceptable isokinetic sampling rates, and demonstration of acceptable posttest leak checks.

Test Report Section 5 Revision 1 June 2002 Page 18 of 20

5.7.3 Data Reporting

Data reporting procedures were performed for field operations as indicated in the following subsections.

5.7.3.1 Field Data Reporting

Field data reporting were conducted principally through the generation of test data tables containing tabulated results of all measurements made in the field, and documentation of all field calibration activities.

5.8 PREVENTIVE MAINTENANCE REVIEW

Well-maintained equipment was an essential ingredient in ensuring the quality, completeness, and timeliness of the field and analytical data. This subsection reviews the schedules of preventive maintenance that were performed to minimize the downtime for critical measurement systems for each contracting company. Also, lists of critical spare parts that were available at the individual field and laboratory sites was developed and reviewed. This subsection represents a review of the preventive maintenance items that were required for the field operations.

5.8.1 Field Instrument Preventative Maintenance

Field source testing equipment and instrumentation that required maintenance and/or calibration were serviced immediately prior to conducting the test program.

Normal spare parts (e.g., control consoles, sample boxes, probes, glassware, sample bottles, etc.) as well as extra materials/supplies (e.g., filters, solutions, solvents, XAD traps, etc.) were scheduled to be available at the field site during testing.

Extra spare parts and equipment for process sample collection and compositing equipment, glassware, sample containers, etc. were scheduled to be available at the field site during testing. Extra materials/supplies (e.g., filters, solvents, etc.) required for the process sample collection were also available at the field site during testing.

Test Report Section 5 Revision 1 June 2002 Page 19 of 20

Sufficient volumes of protocol and calibration gases for the CEM monitoring, extra fittings, sample lines, pumps, heating tapes, and analyzer cells, along with sufficient materials/supplies (e.g., pump oil, filters, etc.) were available at the field site during testing.

5.9 CORRECTIVE ACTION

Corrective action was the process of identifying, recommending, approving, and implementing measures to counter unacceptable procedures or procedures out of QC performance that could affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation, and data assessment. All corrective actions proposed and implemented was documented in the regular QA reports to management. Corrective action was implemented only after approval by the EQ Project Manager or his designee. If immediate corrective action was required, approvals secured from the EQ Project Manager were documented in an additional memorandum.

Depending on the nature of the problem, the corrective action may be formal or informal. In either case, occurrence of the problem, the corrective action performed, and verification that the problem had been resolved were documented. Whenever a corrective action was required, documentation was completed by the individual noting the problem and a copy was filed with the EQ Project Manager.

The shared effort for implementing the corrective action was the responsibility of the EQ Project Manager, the EQ QA Managers, and the Field Team Leaders.

Corrective actions were initiated when data quality problems were determined during the program. These data quality problems were flagged "out of control" if they were outside the predetermined limits specified above for internal, performance, system, and data audits. When discovered, prompt action toward a solution was undertaken by the generator of the data. The corrective action was conducted through the following six activities:

- Define the quality problem.
- Notify the designated individuals listed in the work plan.
- Determine the cause of the problem.

Test Report Section 5 Revision 1 June 2002 Page 20 of 20

- Determine the corrective action.
- Implement the corrective action.
- Verify the solution to the problem.

Corrective action was instituted immediately by the individual noting a problem in a measurement system. An unresolved problem was reported to the EQ Project Manager and the EQ QA Managers for further action.

Test Report Section 6 Revision 2 June 2002 Page 1 of 36

SECTION 6

RESULTS

F119-PW-100 aircraft engine exhaust emissions were characterized to determine the concentration, mass emission rate and emission factor relative to fuel flow for criteria and select hazardous air pollutants. Sampling was performed for nitrogen oxides (NO_x), carbon monoxide (CO), carbon dioxide (CO₂), non-methane hydrocarbons (NMHC), particulate matter (PM), particle size characterization, aldehyde and ketones and volatile organic compounds. Exhaust emission measurements were corrected for background ambient pollutant concentrations. Semi-volatile organic compounds, metals and sulfur dioxide emissions were not part of the scope or work for this engine. Historical aircraft engine emission sampling has noted that the semivolatile analysis have provided non-detected and scattered detected values. Metals analysis have also shown mainly non-detect values, this was confirmed by an analysis of the fuel and particulate matter. Sulfur dioxide emissions are reported based on the procedure documented by AFIERA. This procedure estimates that sulfur dioxide in the fuel undergoes complete oxidation to SO₂. The sulfur content in JP-8 fuel was determined during testing to assure consistency with published results. The emission factor for SO₂ is provided in the report.

As part of the F119-PW-100 emission testing program, samples were collected directly behind the aircraft engine, at the end of the Augmentor tube where the engine exhaust exits the hush house, and in the slipstream duct. As described in section 2 and shown in Figure 2-6, a stainless steel rake with multiple sampling nozzles was installed directly behind the engine to collect gaseous, benzene and formaldehyde emissions data at the idle and approach engine settings. Near the end of the Augmentor tube, where the emissions exhaust the hush house, a stainless steel slipstream sampling system was installed to transfer the engine exhaust out of the hush house to a safe location for sampling. The slipstream rake, shown in Figure 2-9, consists of twelve

sample intake nozzles that were used to determine pollutant distribution in the augmentor tube and to collect a gaseous emission sample from each of the twelve points. After the slipstream had exited the hush house, the slipstream duct was utilized to extract manual samples for PM, aldehyde and ketones and volatile organic compounds. These sampling locations are referred to as the engine rake, slipstream rake and slipstream duct accordingly. The purpose of sampling at multiple locations was to study the pollutant mass emission rates as they traveled from the engine to the atmosphere and note if any secondary chemistry occurred during the residence time in the augmentor tube. The emissions data are discussed in this section.

6.1 GASEOUS POLLUTANTS

Gaseous emissions were collected at the engine rake (idle and approach settings only), slipstream rake and slipstream duct (during the shakedown runs only). The results of the sampling at each location is provided in the following sections.

6.1.1 Shakedown Runs

Prior to the actual emission test runs at each engine setting, a series of shakedown runs were performed to note gaseous pollutant concentrations, and air flows and to refine communication logistics. During the shakedown runs gaseous emissions data was collected for NO_X, CO, CO₂, O₂ and NMHC at 10% (idle), 20% (approach), 70% (intermediate), 100% (military) and 150% (afterburner) engine power at each of the 12 points on the slipstream rake. These sample results were used to determine if pollutant emission rates varied across the augmentor tube. During the shakedown runs, gaseous emissions were also collected directly behind the engine using a multi-point engine sampling rake during the 10% and 20% engine settings only. The engine rake had to be removed at the higher power settings to eliminate the potential for engine and/or hush house damage. At all power settings, gaseous emissions data was collected at the slipstream rake (which is located at the end of the augmentor tube) just

prior to the exhaust to the atmosphere and at a downstream location in the slipstream duct.

Tables 6-1 and 6-2 present the gaseous emissions data collected at the 10% and 20% engine power settings during the shakedown runs. Ambient, engine rake (directly behind the engine), slipstream rake (near the end of the hush house) and stack (near the end of the slipstream duct) pollutant data are compared. Carbon monoxide (CO) concentrations were measured higher at the engine rake when compared to the slipstream rake, due to the reaction of ambient air with exhaust gas to convert CO to CO₂.

Pollutant reaction from the engine to the hush house exhaust was noted in the NO_X data. NO continued to react with dilution air to form NO_2 . This can be seen in the NO/NO_2 ratio. At the 10% engine setting the NO/NO_2 ratio is 0.9 at the engine rake and 0.4 at the slipstream rake. This indicates that there is more NO_2 present in the exhaust stream near the end of the augmentor tube. This same NO_X conversion is seen at the 20% power setting.

As the engine power was increased above 20% the engine sampling rake was removed. Gaseous data collected outside the hush house (ambient), at the slipstream rake and at the slipstream duct are presented in Tables 6-3 through 6-5 for engine power settings 70%, 100% and 150%. These data sets showed strong correlation between sampling points and demonstrated the typical trend in aircraft engine emissions. The CO emissions decreased significantly above 20% power and the NO_X emissions began to increase at the 70% power setting. NMHC emissions were extremely low which is a characteristic of the low by-pass improved combustor technology.

Just prior to commencement of the shakedown campaign, a gaseous emission data collection effort was performed in an attempt to note the power setting when CO emissions decrease and NO_X emissions increase. The idle, approach, intermediate, military and afterburner settings are separated by a relatively large amount of throttle

position and power. Table 6-6 contains the gaseous emissions data collected at the additional settings. The CO emissions begin to trend downward at 12% power with the largest decrease at the 15% power setting. Also, the NO_X emissions begin to increase above 20% power. These data are important with respect to ground idle emissions. CO emissions can be reduced by approximately 64% (by weight) by increasing the engine idle speed from 10% to approximately 15%+.

6.1.2 Gaseous Emission Factors

The emission factors for the F119-PW-100 engine are presented in Tables 6-7 and 6-8. As discussed previously in section 4 of this report, the hush house exhaust rate was determined using three methods. Carbon balance, tracer gas and F-factor methodologies were employed so that each method could be evaluated to note the most representative data set. At all settings the exhaust flow calculated by tracer gas provided the data set most comparable to historic data collected by Pratt & Whitney for the F119-PW-100. The emissions data collected were typical for engines in this class. Historic emission indexes for the F119-PW-100 engine were approximately 7.7 and 17.1 lbs/1000 lbs fuel for NO_x at idle and approach respectively. The data collected during this test program indicated NO_X emission factors of 3.0 and 6.6 lbs/1000 lbs fuel respectively. This comparable trend was noted for the remaining criteria pollutants also. At the intermediate, military and afterburner settings, tracer gas was the most representative method to determine the exhaust flow. The emissions data determined using the tracer gas flow methodology compared well with data provided by Pratt & Whitney for the F119-PW-100. At intermediate and military the CO emission factors provided by Pratt & Whitney were 0.8 and 0.7 lbs/1000 lbs fuel respectively. The data collected during this program yielded emission factors of 2.1 and 0.8 lbs/1000 lbs fuel for CO. Once again, the remaining pollutants provided similar comparisons. The NMHC results at the military and afterburner settings were non- detect since the recorded value was detected near the instrument detection level and due to correction

of data for analyzer drift and the ambient concentration, the corrected value dropped to zero.

Table 6-8 presents the emission factors determined at the engine rake for the idle and approach engine settings. The NOx and CO emission factors at the slipstream rake and engine rake were very comparable. At idle the NOx emission factors were 3.0 lbs/1000 lbs fuel and 1.9 lbs/1000 lbs/fuel for the slipstream rake and engine rake respectively. The CO emission factors at idle were 48.2 lbs/1000 lbs fuel at the slipstream rake and 76.1 lbs/1000 lbs fuel at the engine rake. At approach, the NOX and CO emission factors at the slipstream rake were 6.6 lbs/1000 lbs fuel and 7.9 lbs/1000 lbs fuel respectively. The NOx and CO emission factors at approach at the engine rake were 5.4 lbs/1000 lbs fuel and 7.3 lbs/1000 lbs fuel. At the idle and approach settings the CO was continuing to react in the augmentor tube to form CO₂. This was noted by a decrease in the mass of CO from the engine rake to the slipstream rake and an increase in CO₂ at the slipstream rake.

6.2 VOLATILE ORGANIC COMPOUNDS

Speciation of volatile organic compounds was performed at the hush house exhaust for each engine setting with the exception of afterburner. The highest emission rate of volatiles was at the idle setting. This has been the typical trend in historic engine emission testing. Due to the inefficiencies in engine operation at idle, unburned hydrocarbons tend to be present in the exhaust stream resulting in higher organic emissions. The VOC HAP total at idle was 0.36 lbs/1000 lbs fuel. The detected compounds at each setting were similar to the speciated HAPs determined in historical test programs. Typically, naphthalene, benzene, toluene, ethylbenzene, xylene and styrene were detected in the exhaust stream. This is the same trend noted in the exhaust stream of the F100 family of engines. A summary of the volatile emissions is provided in Tables 6-9 through 6-12.

6.2.1 Speciated Pollutant Comparison

Samples for benzene and formaldehyde were collected directly behind the engine and at the slipstream duct to note the variation in emissions at the idle and approach settings. The benzene emissions determined directly behind the engine are summarized in Table 6-14. These data compare very well to the benzene emission at the slipstream shown in Table 6-9. At idle the emission factor for benzene behind the engine was 0.12 lbs/1000 lbs fuel and 0.11 lbs/1000 lbs fuel at the slipstream. At the approach engine setting, the benzene emission factor was 0.003 lbs/1000 lbs fuel at the slipstream and the engine exhaust. Formaldehyde samples collected at the idle and approach setting behind the engine were compared to the formaldehyde data collected at the slipstream duct. These data are presented in Tables 6-13 and 6-15. The formaldehyde data collected behind the engine, shown in Table 6-15, provided an engine emission factor of 1.29 lbs/1000 lbs fuel at idle and 0.05 lbs/1000 fuel at approach. These data are very comparable to the formaldehyde data collected at the slipstream duct, which indicated an engine emission factor of 1.00 lbs/1000 lbs fuel at idle and 0.04 lbs/1000 lbs fuel at approach. Therefore both volatile compounds and aldehydes can be considered stable during mixing in the Augmentor tube and measurements collected at the slipstream duct can be considered representative of the engine emissions.

6.3 ALDEHYDE AND KETONES

Aldehyde and ketone data was collected at the slipstream duct for the idle, approach, intermediate and military settings. These data are summarized in Table 6-13. The emission rates were highest at the idle setting, which is consistent with the data trends seen in this program. Formaldehyde was the pollutant emitted in the highest quantity at 1.00 lbs/1000 lbs fuel at idle. As the engine moved from idle to the higher engine settings the emissions decreased accordingly. Formaldehyde emissions were 0.008 lbs/1000 lbs fuel at military.

6.4 POLLUTANT MIXING IN THE AUGMENTOR TUBE

Pollutant mixing in the Augmentor tube was examined through the use of 12 sampling points within the Augmentor tube fixed to the slipstream rake. The points were positioned according the to procedures in EPA Method 1 and are provided in Figure 6-1. By investigating the relationship between the tracer gas and emissions from the engine we could define the profile within the augmentor tube (at the point of collection, the slipstream rake) for both tracer gas mixing and engine emissions. At idle and approach CO was compared to SF₆, CO was chosen because of relative high concentration and resolution. NO_x was selected at intermediate and military because of its high concentration and resolution. The concentrations of SF₆ varied by 9%, 5% and 4% between the highest and lowest value observed from the 12 sampling points at idle, approach and intermediate, respectively. This indicated that SF₆ was well distributed with the ambient air entering the hush house and into the augmentor tube. The variance in CO concentrations was 17% and 12%, and for NO_X, 15% between high and low with the highest concentrations in the lower and central portion of the slipstream rake at idle, approach and intermediate, respectively. This indicated that exhaust flow from the engine was more laminar and combustion gas was centered in the augmentor tube. The variance in emissions does not impact sample collection since the gaseous emissions were collected at all 12 slipstream rake intake points and averaged and the inorganic and volatile samples were collected from the slipstream duct where there was a slight increase in concentration. The data showed at the tested conditions, that stratification of the engine exhaust was not significant.

At military, SF_6 showed stratification, as there was a 14% difference between the highest and lowest value observed from the 12 sampling points. NO_X show a 20% difference with the highest concentrations observed at the lower and central portion of the slipstream rake. At the military setting, the force of the engine exhaust developed a more stratified flow structure through the augmentor tube and the hush house as well, as indicated by the degraded mixing of SF_6 with the ambient air.

Though minimal stratification was present at all engine settings the data was not significantly biased (and if a bias exists it would generally favor higher emission rates) because for gaseous pollutants the integration of results from the 12 points was used and the inorganic and volatile samples were collected from the slipstream duct where there was a slight increase in concentration.

6.5 PARTICULATE MATTER

The total particulate emissions are presented in Tables 6-17 through 6-20. The results represent the total particulate, condensable and filterable, exiting the hush house. EQ was successful in capturing the entire particulate size range in the emission stream. A discussion of the method abnormalities is provided.

The particulate sampling methodology was improved in several ways over past sampling campaigns in order to improve the detection limit in the exhaust stream. EQ, USAF and Navy (SPAWAR SYSCEN D3621) personnel reviewed the historic sampling procedures and developed the following improvements:

- A smaller 47 mm diameter filter was used in the EPA Method 5 train. The intent
 was to have a lower filter tare weight and therefore have the ability to detect a
 small particulate gain since the gain in total weight would be a larger percentage
 of the filter tare weight.
- An analytical balance accurate to 5 decimal places (0.00001 grams) was used.
 This allowed for a more accurate gravimetric analysis since the method balance was accurate to 4 decimal places.
- The humidity of the weighing room was below 50% humidity.
- A real time particulate analyzer was used as a backup to the EPA Method 5 train to confirm particulate emission results.

The improvements made in the sampling and analytical scheme did not provide improved results. Due to the extremely low concentration of particulate matter in the engine exhaust stream, the filter gain after an extended test run with a large sample volume, was still insignificant using EPA Method 5. The EPA reference method is at or

below the detection limit in this application. The filter fraction of the sample resulted in negative particulate gain for two reasons. The recovery procedure, per the EPA Reference Method, requires the filter sample to be removed from the support frit and associated gasket which seals the filter holder. Due to the high sample vacuum in order to meet the extended sample volume requirements, the gasket would seal to the filter and pieces of the filter remained on the gasket during sample recovery. Therefore the filter material had to be scraped from the gasket. The second reason for the low weight gain from the filter analysis was that during sample collection, following the EPA Reference Method, the filter material was removed and deposited into the impinger solution during sample collection. The heating of the filter and the large volume of sample and vacuum applied to the filter resulted in minor filter loss. This was simulated at the WESTON laboratory and confirmed that filter material was lost and deposited in the impinger solution and appeared in the inorganic faction analysis results. Since filter material appears to have been lost and recovered in the impinger solution it is not known if the filters collection efficiency was also affected. This was also seen in the particulate sample results, when the filter lost weight, there was generally a proportional increase in the inorganic fraction of the condensable particulate matter.

The total particulate matter is presented and provides the best results based on the sampling anomalies. The filterable fraction consists only of the probe rinse and the condensable fraction (organic and inorganic) consists of the particulate that passes through the probe and filter, which also contains a small portion of the filter. Therefore the total particulate (consisting of probe rinse, inorganic and organic condensable sample factions) results may be the most representative emission index accounting for a portion the loss in filter material and potential particulates that could have migrated through the filter due to the potential decrease in collection efficiency.

Particulate emission results for this engine were comparable to historic data sets. The engine also noted a similar emission trend pattern. The emission index was highest at idle 2.5 lbs/1000 lbs fuel and averaged near 1.5 lbs/1000 lbs fuel for the

remaining settings. The variation in the data is the result of normal method variability. As a comparison, the particulate data for the F100-PW-100 engine was reviewed to note the similarities in the data sets. At idle the F100-PW-100 engine had and emission index of 2.8 lbs/1000 lbs fuel and for the test engine the factor is 2.5 lbs/1000 lbs fuel. At approach the F100-PW-100 emission factor is 1.97 lbs/1000 lbs fuel and for the test engine it is 2 lbs/1000 lbs fuel. At intermediate the emission factors were both 1.5 lbs/1000 lbs fuel for the F100-PW-100 and test engine respectively. At military the emission factors were 1.5 and 2.1 lbs/1000 lbs fuel for the F100-PW-100 and test engine respectively.

The real time particulate analyzer was unable to operate in the engine exhaust environment as set-up during this program. The vibration generated by the engine was amplified through the temporary structure the instrument was mounted on (temporary ductwork and scaffolding). This created difficulties in data collection and equipment operation as the instruments measurement principal is based on measurement of vibration. It is much more likely this method would have succeeded if the instrument would be been mounted in more stable test facility (engine test cell). The equipment failed in the field and was unable to record data. The equipment was able to collect, on an auxiliary filter, an isokinetic particulate sample for particle size distribution analysis.

6.5.1 Particle Characterization

As discussed earlier in this section, the real time particulate analyzer was used to collect an isokinetic sample for particle size analysis. The sample was collected on a silver membrane filter for analysis via scanning electron microscopy to count the particles in each size range. The results of the particle counts are provided in Table 6-18. The analysis determined that the majority of particulate matter (>97%) was below 10 microns in size with >70% of the particles at a diameter <2.5 microns. The pore size of the filter was 0.5 microns, therefore particles less than 0.5 microns in diameter may have passed through the filter. Additional analysis was performed to examine particles

less than 0.5 microns by transmission electron microscopy (TEM) and elemental analysis of particles less than 10 microns by automated SEM.

The relatively large particles (7.5 microns and larger) were determined to be angular brittle carbon particles which most likely have been heated and cooled and deposited on a surface such as the engine tail section or hush house augmentor tube and suspended during testing and deposited on the filter. These particles are not a combustion product during emission testing but a disturbed particle. Some of the remaining relatively large particles (1 to several microns) were carbon soot agglomerates. The "bundles" of particles consisted of carbon spheres with a diameter of 0.03 to 0.05 microns. Therefore, even though the size distribution indicates particles greater than 0.5 microns in diameter, a number of the particles are groups of smaller particles in the submicron size range. It appears that the majority of the particles >2.5 microns are groups of smaller particles in the 0.03 to 0.05 micron size range. As the fuel firing rate increases, the percentage of particles less than 2.5 microns also increases. These particles are primarily carbon soot. The submicron particles would be captured in the impinger solution of the EPA Method 5 sampling train.

The particle types consisted of silicon, sulfur and iron. There were small quantities of chrome and titanium present in select samples. There was large quantities of aluminum and silver present but these were thought to be a result of the silver membrane filter since a large quantity of these materials were verified on the filter blanks.

6.6 EXHAUST FLOW DETERMINATION

The engine exhaust flow was determined using several methods in order to provide an opportunity to review data sets and disregard outliers. Carbon balance, tracer gas and F-factor were used to determine the exhaust flow rate. The tracer gas methodology was not used to determine emissions directly behind the engine since the tracer gas could not be measured at the engine rake. The F-factor methodology tended

to fail at oxygen concentrations greater than 18.5%. The carbon balance and tracer gas flow calculation methods provided good correlation. The tracer gas data tended to provide a better comparison with historical flow and emissions data at all settings.

6.7 FUEL ANALYSIS

Fuel samples were collected during the emission test program from the fuel line feeding the engine. The fuel was analyzed to determine the presence of select metals. In each sample, small quantities of copper, zinc and phosphorous were present. In one sample a small quantity of nickel and thallium was present. The fuel analysis results represented in Table 6-22.

6.8 ENGINE OPERATION

During the emission test program, specific engine parameters were monitored to note engine performance. Pratt & Whitney personnel were responsible for collecting and maintaining the operating data and for operating the engine in a safe manner. A summary of the engine operation is provided in Table 6-23.

TABLE 6-1. F119-PW-100 GASEOUS EMISSIONS SUMMARY 10% POWER SETTING

Sampling Location	õ	High	Low	2	NO2	Š	ឣ	NMHC	Ŧ	පි	Amb.	Amb.	Virtual	Amb.
		°C)	co,								욷	ਤੋਂ	Ambient NMHC	င်ဝ
	dry %	dry %	dry ppm	dry ppm	dry ppm	dry ppm	dry ppm wet ppm wet ppm	wet ppm	wet ppm	dry ppm	wet ppm	wet ppm	wet ppm	wet ppm
							(as C ₃ H ₈)	as C ₃ H ₆) (as C ₃ H ₆)	(as CH4)		(as C ₃ H ₆)	(as CH4)	(as C ₃ H ₈)	
Ambient	20.4	0.4	395	0.5	0.5	1.0	2.3	1.4	2.5	0.0	1.0	5'0	0.8	524
Engine Rake	18.4	1.6	Saturated	4.3	4.8	9.1	29.6	282	4.3	439.8	1.5	2.0	0.7	396
Slip Stream Rake	20.1	0.5	Saturated	0.5	14	2.0	6.1	4.9	3.5	52.6	1.0	2.1	0.3	370
Slip Stream Duct	20.2	0.5	Saturated	0.5	1.4	2.0	6.0	4.8	3.5	54.4	1.0	2.5	0.2	331
NOTE: Veluce and read in BOI D have been edited of contrators and and an additional and additional additional and additional addit	POLO Page P	700	on journal of the second											
NOTE: Values effected in BOLD flave been adjusted to internal consistency a Negative values (after calibration bias correction) have been increased to zero.	ration bias c	orrection) has	y for internal come	sistenicy as	IOIIOWS,		in an a security transmission in the special	AND IN THE CHARGE AND DESCRIPTION OF THE PARTY OF			And the second s			
NMHC values have been adjusted to reflect the difference between the THC and methans values for both source and ambient locations.	djusted to re	flect the differ	rence between th	he THC and n	nethane value	es for both sc	ource and ami	bient location	S.					
NO2 values have been adjusted to reflect the difference between the	usted to refle	ct the differen		measured N	ox and NO va	lues., excep	it when ambie	int measurem	ne measured Nox and NO values., except when ambient measurements are made.		•			
For ambient measurements, the NO number was adjusted to reflect the difference between the NO2 and NOx values.	ts. the NO nu	Imber was ac	insted to reflect	the difference	e between the	a NO2 and N	Ox values.							

Test Report Section 6 Revision 2 June 2002 Page 14 of 36 TABLE 6-2. F119-PW-100 GASEOUS EMISSIONS SUMMARY 20% POWER SETTING

and the first channels of the sea and their transfer to the communication of the first of the fi	The same of the sa				907			2						
Sampling Location	0	High	Low	ջ	NO ₂	XON.	THC	NMHC	Ŧ.	ខ	Amb.	Amb.	Virtual	Amb.
		ģ	ပ်							AMERICAN PROPERTY OF A ALCOHOLOGICAL STATE OF THE STATE O	CHL	ij	Ambient NMHC	
I I I I I I I I I I I I I I I I I I I	dry %	dry %	dry ppm	dry ppm	dry ppm	dry ppm dry ppm	wet ppm	wet ppm wet ppm	wet ppm	dry ppm	wet ppm	wet ppm	wet ppm	wet ppm
							(as C ₃ H ₈)	(as C ₃ H ₈) (as C ₃ H ₈) (as CH ₄)	(as CH4)		(as C ₃ H ₈)	(as CH ₄)	(as C ₃ H ₈)	
Ambient	20.7	0.3	367	1.0	6.0	1.0	1,3	0.4	2.5	0.0	1.0	4.2	0.0	416
Engine Rake	18.5	<u>6</u>	Saturated	23.7	5.2	28.9	4.0	3.5	1.5	63.9	1.0	3.9	0.0	368
Slip Stream Rake	20.3	0.5	Saturated	2.4	1.4	3.8	9.	1.0	2.6	7.5	1.3	3.5	0.2	375
Slip Stream Duct	20.4	0.5	Saturated	2.8	1.3	4.1	2.0	1.2	2.5	4.9	1.0	4.4	0.0	320
NOTE: Values entered in 801 base been adjusted for internal conse	301 D base he	on adjusted f	or internal cone	etorics of follows:	lowe.									
Negative values (after calibration bias correction) have been increased	ration bias co	rection) have	been increased	d to zero.										
NMHC values have been adjusted to reflect the difference between the THC and methane values for both source and ambient locations.	djusted to refle	ect the differe	ince between the	e THC and m	ethane values	for both sou	urce and ambi	ient locations.						
NO2 values have been adjusted to reflect the difference between the m	usted to reflec	t the differenc	se between the	measured No.	x and NO valu	les., except	leasured Nox and NO values, except when ambient measurements are made.	nt measureme	nts are made.					
For ambient measurements, the NO number was adjusted to reflect the difference between the NO2 and NOx values.	s, the NO nun	nber was adju	usted to reflect t	he difference	between the	NO2 and NC)x values.							
							THE STATE SALE STATE SHAPE	A.11 444111 part table 11.11.11.11.11.11.11.11.11.11.11.11.11.	***************************************					

Test Report Section 6 Revision 2 June 2002 Page 15 of 36

TABLE 6-3. F119-PW-100 GASEOUS EMISSIONS SUMMARY 70% POWER SETTING

Transcendent of the first annual communication is not being the contract of th					?	j :))						
Sampling Location	ő	High	Low	2	NO ₂	NO.	托	NMHC	Ŧ	පි	Amb.	Amb.	Virtual	Amb.
		6											Ambient	
		ວິ	3								H H	Ę	Z E Z	င်ပ
	dy %	dry %	dry ppm	dry ppm	dry ppm	dry ppm	wet ppm	dry ppm wet ppm wet ppm	wet ppm	dry ppm	wet ppm	wet ppm	wet ppm	wet ppm
							(as C ₃ H ₆)	(as C ₃ H ₆) (as C ₃ H ₆)	(as CH4)		(as C ₃ H ₈)	(as CH4)	(as C ₃ H ₈)	
THE THE PERSON OF PERSONS ASSESSED TO THE PERSON OF THE PE														
Ambient	21.5	0.2	434 24	9.0	0.5	1.1	1.9	60	3.1	15.8	1.0	4.1	0.0	565
Slip Stream Rake	20.6	0.4	Saturated	10.4	1.6	12.0	1.5	9.0	3.1	3.4	1.3	5.5	0.0	453
Slip Stream Duct	21.0	0.5	Saturated	10.6	1.7	12.3	1.5	0.5	3.1	0.5	2.0	6.1	0.0	563

NOTE: Values entered in BOLD have been adjusted for internal consistentcy as follows:	LD have bee	n adjusted fo	r internal consis	stentcy as foll	OWS.									
Negative values (after calibration bias correction) have been increased to zero.	tion bias con	rection) have	been increased	to zero.		*								
NMHC values have been adjusted to reflect the difference between the THC and methane values for both source and ambient locations.	usted to refle	ct the differen	ice between the	THC and me	thane values (or both sour	ce and ambie	int locations.						
NO2 values have been adjusted to reflect the difference between	ted to reflect	the difference	s between the m	easured Nox	the measured Nox and NO values, except when ambient measurements are made.	S. except w	when ambient	measuremen	ts are made.					
For ambient measurements, the NO number was adjusted to refle	the NO num	ber was adjus	sted to reflect th	ie difference t	act the difference between the NO2 and NOx values.	O2 and NO	ralues.							
				THE R. P. LEWIS CO. L.	THE PARTY OF THE P	THE PARTY OF THE P	CONTRACT TO THE PROPERTY OF TH	ALL DESCRIPTION OF THE PROPERTY OF THE PROPERT	THE REAL PROPERTY AND PERSONS ASSESSED.		The state of the s			

Test Report Section 6 Revision 2 June 2002 Page 16 of 36

TABLE 6-4. F119-PW-100 GASEOUS EMISSIONS SUMMARY 100% POWER SETTING

	***************************************	A Section of the sect			?])						
Sampling Location	õ	High	Low	9 .	NO ₂	Š	윒	NMHC	Ą.	ខ	Amb.	Amb.	Virtual	Amb.
,		<u>ဝ</u>	Ó								Ë	3	Ambient NMHC	ć
	dry %		0	dry ppm	dry ppm	dry ppm	dry ppm wet ppm wet ppm wet ppm	wet ppm	wet ppm	фу ррт	wet ppm	wet ppm	wet ppm	wet ppm
			(Ambient)				(as C ₃ H ₈)	(as C ₃ H ₆) (as C ₃ H ₆) (as CH ₄)	(as CH₄)		(as C ₃ H ₈)	(as CH₄)	(as C ₃ H ₈)	
Ambient	210	0.1	338	60	0.0	1.1	13	YU	36	00	0 6	15	1	203
Slip Stream Rake	202	0.6	333	33.0	14	35.3	ο 0		17	300	1.3	2.5		200
Slips Stream Duct	,	9.0	334	35.8	1.7	37.6	. t.	0.4	2.6	0.0	1.0	1.0	0.7	483
											The state of the s			
NOTE: Values entered in BOLD have been adjusted for internal cons	OLD have be	en adjusted f	or internal consi	istentcy as follows,	lows;									
Negative values (after calibration bias correction) have been increased to zero.	ation bias co	rrection) have	ı been increased	to zero.										
NMMC values have been adjusted to reflect the difference between the THC and methane values for both source and ambient locations.	justed to refl	ect the differe	nce between the	THC and me	thane values	for both sou	rce and ambi	ent locations.						:
NO2 values have been adjusted to reflect the difference between the measured Nox and NO values, except when ambient measurements are made.	sted to reflec	t the differenc	e between the n	neasured No	and NO valu	es., except	when ambient	measuremer	nts are made.					
For ambient measurements, the NO number was adjusted to reflect	s, the NO nun	nber was adju	isted to reflect t	the difference between the NO2 and NOx values.	setween the	VO2 and NO	x values.							

Test Report Section 6 Revision 2 June 2002 Page 17 of 36

Test Report Section 6 Revision 2 June 2002 Page 18 of 36

TABLE 6-5. F119-PW-100 GASEOUS EMISSIONS SUMMARY 150% POWER SETTING

ACTION OF THE RESERVE OF THE PROPERTY OF THE P			A CONTRACTOR OF THE PROPERTY O)						
Sampling Location	õ	Нg	Lo₩	2	NO ₂	Š N	THC	NAHC	ť	පි	Amb.	Amb.	Virtual	Amb.
		င်ဝ	°								THC	ť	Ambient NMHC	. 600
	dry %		dry % dry ppm (Ambient)	фу ррш	dry ppm	dry ppm	wet ppm	dry ppm dry ppm wet ppm wet ppm dry ppm (as C.H.) (as C.H.)	wet ppm	фу ррш	wet ppm	wet ppm	wet ppm	wet ppm
Amhient	21.0	0.4	324	60	00	* *	(A. (C. C.)	(A) (C)			(a) (b) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c	(1) (2)	(B) (C) (D)	
Slip Stream Duct	18.9		326	0.0	7.7	35.4	9.0	0.0	1.5	127.3	1.0	2.0	0.3	350 552
			THE RESERVE THE PROPERTY OF TH								1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			
NOTE: Values entered in BOLD have been adjusted for internal cons Negative values (after calibration bias correction) have been increase	SOLD have by ration bias co	een adjusted 1 prrection) have	for internal consi 9 been increased	sistentcy as follows; ed to zero.	ilows;								A C C C C C C C C C C C C C C C C C C C	
NMHC values have been adjusted to reflect the difference between t	Jjusted to ref	lect the differe	ance between the	e THC and me	e THC and methane values for both source and ambient locations.	for both sou	irce and ambi	ient locations.						
NO2 values have been adjusted to reflect the difference between the	isted to reflec	ot the different	ce between the 1	measured No:	measured Nox and NO values., except when ambient measurements are made.	ies., except	when ambien	nt measureme	ints are made					
For ambient measurements, the NO number was adjusted to reflect the difference between the NO2 and NOx values.	s, the NO nu	mber was adju	usted to reflect t	he difference	between the	NO2 and NC	X values.							
						***************************************	Annual Color of the Color of Color Color Color	references to the same of the	A Ad in court to exceed property and the		Attended the state of the state	A		

TABLE 6-6. F119-PW-100 GASEOUS EMISSIONS SUMMARY VARIOUS POWER SETTINGS SLIPSTREAM RAKE

					J 0	ロヒークレ	コンサン マイン・ファン・ファン・ファン・ファン・ファン・ファン・ファン・ファン・ファン・ファ	U Z						
Power Setting	0	High	Lo₩	õ	NO ₂	o N	THC	NAHC	ťť	ខ	Amb.	Amb.	Virtual	Amb.
													Ambient	
		රි									된	Ŧ.	NMHC	င္ပိ
(c)	dry %	dry %	dry ppm	dry ppm	dry ppm	dry ppm	wet ppm	wet ppm	wet ppm	dry ppm	wet ppm	wetppm	wet ppm	wet ppm
12.50							(as C ₃ H ₈)	(as C ₃ H ₆)	(as CH4)		(as C ₃ H ₈)	(as CH4)	(as C ₃ H _B)	
10%	20.6	0.5	Saturated	0.0	2.0	2.0	12.0	10.7	3.9	59.0	2.3	5.6	0.4	348
12%	20.6	0.5	Saturated	0:0	2.0	2.0	5.4	4.1	3.9	35.6	2.3	4.5	0.7	451
15%	20.6	0.5	Saturated	0.5	2.4	2.9	3.6	2.3	3.9	21.4	2.3	5.6	0.4	410
20%	20.6	0.5	Saturated	1.6	2.4	3.9	8 :	0.5	3.9	4.6	1.9	4.0	0.5	475
65%	20.4	0.7	Saturated	8.6	2.4	12.2	1.8	0.5	3.9	0.0	2.3	4.5	0.7	469
%02	20.4	0.7	Saturated	11.9	2.3	14.2	8.	8.0	2.9	0.0	1.9	4.5	0.4	324
%08	20.3	8.0	Saturated	17.1	2.4	19.5	1.8	0.8	2.9	0.0	2.3	4.0	6.0	416
100%	20.3	60	Saturated	38.9	2.2	41.0	8	9.0	2.9	0.0	1.9	4.5	4.0	317
150%	19.1	1.5	Saturated	32.6	6.5	39.1	11.4	10.4	2.9	87.5	2.3	4.5	0.7	390
A PARTY OF THE PAR									1					
NOTE: Values entered in BOLD have been adjusted for internal consists	BOLD have be	en adjusted f	for internal consi	stentcy as follows;	llows;									
NMHC values have been adjusted to reflect the difference between the	diusted to refle	act the differen	nce hetween the	THC and me	sthane values	tor hoth so	THC and methane values for both source and ambient locations	ent locations						
NO2 values have been adjusted to reflect the difference between the m	usted to reflect	t the differenc	e between the n	neasured No	c and NO val	ues. except	easured Nox and NO values. except when ambient measurements are made	t measureme	nts are made.					
For ambient measurements, the NO number was adjusted to reflect th	ts, the NO nun	nber was adju	usted to reflect to	he difference	e difference between the NO2 and NOx values	NO2 and NC)x values.							
All data collected at the slipstream rake.	lipstream rake.									,				
			4	C11141 D1114 C11111 C1111 C111			¥4	Y	***************************************					

Test Report Section 6 Revision 2 June 2002 Page 19 of 36

TABLE 6-7. F119-PW-100 SLIPSTREAM RAKE EMISSION FACTOR SUMMARY

many alaka wan pengala ang ang ang ang ang ang ang ang ang an							Engin	Engine Mode		:				:		: .
		elpi			Approach			Intermediate	۰		Milhary		_	2	Afterburner	
Flow Rate, dscfm		289029			563582			1458213			1823426				1832439	
			lbs/1,000			lbs/1,000			000' L/sql			lbs/1,000		_	9	lbs/1,000
Analyte	phundd	lb/hr	los fuel	ppmvd	lb/hr	lbs fuel	phundd	lb/hr	bs fuel	phundd		lbs fuel	ā	pwwdd	= Pur	lbs fuel
Mitrogen Oxide (NO)	0.5	0.68	0.49	2.4	7.44	2.72	10.4	98.02	7.01	33.9	230.98	12.41	8	28.0	90.78	3.80
Nitrogen Dioxide (NO ₂)	1.4	2.90	2.11	1.4	99'9	2.43	1.6	16.71	1.65	1.4	14.63	0.79	_	7.7	80.44	88
Nitrogen Oxides (NO _X)	2	4.14	3.01	3.8	18.06	6.59	12.0	125.36	12.40	35.3	368.76	19.81	**	35.4	369.60	7.37
Carbon Monoxide (CO)	52.6	66.30	48.15	7.5	21.71	7.92	3.4	21.62	2.14	2.2	13.99	0.75	12	127.0 80	29.708	16.10
Net NMHC (as C ₃ H ₈)	4.6	9.41	6.83	0.2	0.94	0.34	0.5	5.35	0.53	0.0	000	0.00	9	7.0	9.27	0.18
Carbon Dioxide (CO ₂), a	0.5	4662	3386	0.5	2806	3426	0.4	36208	1898	9.0	54312	2918	-	1.1	26728	2526
Sulfur Dioxide (SO ₂)	₹	0.52	0.38	₹	1.04	0.38	¥	3.84	0.38	¥	7.07	0.38	z	NA 1	19.06	0.38
								4								
NU - Value represents method detection limit. Compound may be prese	limit. Compou	nd may be pres	sent at a value l	ent at a value less than the detection limi	etection limit.											
NA - SO2 rates determined from fuel sulfur content.	ır content.															
a - CO2 data based on carbon balance flow determination.	w determination	ć														
		***************************************	Anti de un communicament		Annual Control of the Party of	***************************************	,	· · · · · · · · · · · · · · · · · · ·				***************************************		***************************************	***************************************	STATE AND PERSONS ASSESSED.

(Flow By Tracer)

Test Report Section 6 Revision 2 June 2002 Page 20 of 36

Test Report Section 6 Revision 2 June 2002 Page 21 of 36

TABLE 6-8. F119-PW-100 ENGINE RAKE EMISSIONS FACTOR SUMMARY (Flow By Carbon Balance)

		a friend for the for the for the file of the condition of the file.	Engine	Engine Mode	edes de destre de destre en tra son annotas destre destre destre destre des	
		ldle			Approach	
Flow Rate, dscfm		39648			71637	
			lbs/1,000			lbs/1,000
Analyte	ppmvda	lb/hr	lbs fuel	ppmvda	lb/hr	lbs fuel
Nitrogen Oxide (NO)	4.3	08.0	0.58	23.7	7.93	2.90
Nitrogen Dioxide (NO ₂)	4.8	1.36	0.99	5.2	2.67	76.0
Nitrogen Oxides (NO _X)	9.1	2.58	1.88	28.9	14.83	5.41
Carbon Monoxide (CO)	439.8	76.05	55.23	63.9	19.96	7.29
Net NMHC (as C ₃ H ₈)	27.5	7.60	5.52	3.50	1.75	0.64
Carbon Dioxide (CO ₂)	1.6	4347	3157	1.8	9836	3225
Sulfur Dioxide (SO ₂)	NA	0.26	0.19	NA	0.52	0.19
$a = ppm \ by \ volume, \ dry$						
NA = Emissions determined by fuel sulfur content.	ır content.					
Note: Engine Rake was used only at the Idle and Approach conditions	Idle and App	roach condit	ions.			

Test Report Section 6 Revision 2 June 2002 Page 22 of 36

TABLE 6-9. F119-PW-100 EMISSIONS FACTOR SUMMARY VOLATILE ORGANIC COMPOUNDS (VOCS)

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Flam Base darks					1		4				1			
WELL THE LAW COLUMN			600				509		_		200		_	
		ž	May 000 000 total	De fuel		\$A	O STA	MA 000 Pr. Cal.	_	254	land (CO) but the	Dr. Sed		
į	CAS Market	Detection		Detection				Detection		-		Petectors		14 000 544
1		W.A. STATE	2		7	ALIAN MARKET	200	Š	4	5		, ma	ž	Į
M. A. P. C.	2.70	DIES ALD	DIEK-43)		_	0000		0000	W OODE-OD		000E+00		0035	OCHE CO
Vieyt Chlonds "	7707	6 125.04			3	1,000,00		13	3	\$ X 5		m 10362 m	L	Ş
Bemeninthase 7	74839	2.96€00			3	> 105-03		2195.40	2	7635-03		> 40E/03	Q	Ş
Chlospethane *	75003	5 12E-04		4675-04	3	1 806-04			1	4 X.F.O.		ŀ	L	9
Frech 11 (Fechine Guerornethane)	7577	1 896-03	1786		,	2316:03	2004.01	1	Train 1	L	10,000	1	ľ	3 VIK AV
1, I-Dichlecoethene "	198.52	5.12E.04		4675.04		VOEON !		77 100. 1	177	C 26 P.		1 778.01	9	
Mettivians Chlords II	7506.2	9 28E CS	10.00		-	2000	1	Ŀ	2	l	- W. A. W.	1	ľ	
1, t-Dichlorodifiane H	75.34.3	6 175.04		4 6.75.04	; - -	1805.04		14.50		20.30	7	10000	3 XX	
Chinofons	57.55.7	1/2013		ŀ		2000		п				1	1	
1 1 Trichtenterhone *	71.45.5	7.5		. .	1			1	3 :	2000		Ŧ	3	
Carbon Setrachlonds H	46.734	1.006.04	70107	l	t	's XC Us	2000	1	Ľ	1	10.00	4 (36) 4	2	e i
Parasta	21.22	1 606.01							2		3			3
1 2. Derkonethane	116.76.3	27.00.7		* 6 945 0.4	+	- NEW .	1 100		54.	1	0.86		1050	20.5
			***************************************	-				. 1	3	Š		3	2	2
out the section of	9104/	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		16.50	3	5 20 7		``	3	5 XE 5		. 29€04 E	9	ş
2-Dichlerspropane	7567.5	5 125.04		4 67E-04	n m	4.000.04		***	W	5 38C 04		10367	2	Ş
Vant-1,3Dichbeconopene	100010046	\$135.04		10350	n	PO-308 P			m	5 XE 04		73827	3	9
Takiren H	100-98 3	\$215.02	20-309 B		-	8 17E 02	7450		CD-376 B	ı	0 35t d	1	ê	R CONF. A.S
tas:1.3 Dichloraprapene H	10081-01-5	\$125.04		4 67E OF	3	10 908 7		10 396.7	3	6 XF.04		A 79F.OL	9	Ş
1,1,2-Trechtproethane**	\$00£	#) 3C1 %			3	4,605.04	_	20-187	3	4.25.504		ŀ	L	ş
Tetrac Mynoelbane	127.18-4	7.17604	6535-04		7	2898-04	2.6504			7.00		ŧ	Ľ	1 S
Chlorabanzana "	108-50-7	S 125/04		4 575-04	3	4.000.04		10 JK 7	3	\$ 256.01		ŧ	1	£
Emyl Senzene #	100-61-4	235e07	215242		7	2.21£-02	2018-02		Daisc L		2016.02	1	ŕ	2000
Sap-Xytens #	28.30	6.63E-02	\$ 135.00	-	•	5.206.03	0500		S XA		WW.		6	A SIE
o-kylene "	#2-17-E	3 946-02	3,505.02	-	3	3.642-02	3505.00	***************************************	385.0		10.40		Ser.	1 404
Shirene H	943-001	4 (00:02	401E4D		-	4185-47	3815-00		131600		3935.00		4 30F-02	1995.00
1.1.2.2. Tatracidorastrana P	38.24	103615		10201	3	70-306 P	_	75 355,7	3	525.0		1,795.04	↓_	9
Acetorie	144/9	00 = 400 d	OC TO		30 1 50	0.00E-400	00%		J 000-10		000		OCCEPTED IN	ome-mo
Carbon Drustide "	75.750	5.12604		* 675.CM	-	*0.900 F		7076.7	180			1780	9	Q
trant-12-Dichloroemene	165-60-5	5126.04			3	4 00E-04			a	5 XE 04		ŀ	9	9
SANT ACALAIN M	100-05-4	2955.03		2.33E-03	3	(D)308 (\$ 19E.00	78	00-3K9 <		A STREET	gy m	ĝ
2-Batanone (MEK) "	78.83.3	0.006-00	0.000		00 F	0006-00	OCOF-CO		J 0005+00		0005-00		000640	0006-00
Bromodichicramentane	15.374	NO-321 S		4.672-U4	3	1 (CP-04	L	さま。 7	3	5 XE-01		1,198,42	ON IN	æ
4-Methy£2 pertanone (Milbe) "	106-10-1	2.558.03		2335-03	-3	2.40E-03		1	3	2 636-03		1	9	3
2 Herandon	£91.78.6	3860			3	2.40€ 03		1	3	2636.03		0.30	9	₽
Dipremechioremethene (Chlorochumenethene)	124.66.1	7.5€ 1.5€		4.67E-UI	3	10-306-7		134-01	3	5.35.04		m 10%:1	Q.	Ŷ
Bromoform **	75.52	5.126-04			3	7			3	5260			9	2
cra-1,2-Criefkonasthena	155-79-2	10.301		4 ETE-DA	m	4 RE-04		136.04	m	5.3E.04		479E-04	QV III	GN
1,3 Estadono	100:390	70-365 C	3645.02		7 1	7696-02	7.616.02		CD-3968 1 C	ı	70 351 G	,	CD 3/89 1	20-39E 9

ND. Compained not delected as this detection land. Compound may be present as value less than the detect

E. Pesufic are estimated, value reported a outside foesarvacking cauge.

O. Eurands quality course limits. (An example of this is the % spake recovery limit was not in

1. The attended former at raise is an exemple quantly because the reported contractes were less than the required detection tenses or quantities. The attendes was and detected above the example countries in this following that attended larger for the second state.

bb - The sample media kinds eacher sample faile Black valva with two times the sample value. Sample result in 1. This competual is laised as a face action as contained (1987).

Results reported at QCD redicate a detected without political concentration present that the defenced political construction in the submast stream.

Material Consequence analyzed in the political process are a streamed communical manner and necessarily communication has made and the manner of the consequence of the

Test Report Section 6 Revision 2 June 2002 Page 23 of 36

TABLE 6-10. F119-PW-100 EMISSIONS FACTOR SUMMARY VOLATILE ORGANIC COMPOUNDS (VOCs)

Approach (Flow by Tracer)

							Rus	Run Humber							
				-				2				3			
LIOW HAIG, OSCIM				66-3682				663682				283636		Ava	Average
The second control of		840	Detection	Par Million India	Defection	5	Ar Detection	leut 2000, thed	Da fuel	=	Į.	evi 200 lbs fue	lbs fuel		
Analyte	CAS Number	Detected	Ë	Detected	Limit	Detected	Limit	Ontected	Linit	Detected	Cimit	Detected	Limit	ž	sol COL Fad
Chloromethane	74.87.3	0 00E+00		0.00E+00	- 1	0.00E+00		OD+ 300 0		0.00E+00		0.00E+00	,	0.00E+00	0 COE+CO
Vinyl Chondo	7,000		1.27E-03		4 61E-04 NO		1.50E-CG			0	1 30E-03			QN	Q
Chlorothan	75.00.3		6.33E-03		- 1		7.49E-03		- 1		6515-03		- 1	ð	£
Freon 11 (Inchlorofluoromethane)	76857	1625.73	1.2/5-00	S PROF DA	4 PTE-U4 NO	0 155.00	1 205-03	2016.00	5.45E-04 ND	4	1.30E-03		4.74E.04 ND	2	Q
1,1-Dichloroethene H	75:35-4		1.27E.03		A SIF ON	┸	1 205.00	3000	E 45E OF NO	34/540	. soe w	- WEAR	1	BD G	1.616-03
Methylene Chloride M	75-09-2	000E+00		0.00E+00		0.00E+00		0.000		0.005	SUE-US	00000	W WEST	QN SINCE	CN
1,1-Dichloroethane H	75-34-3		1.27E-03		4 61E-04 ND	L	1.50E-03		5.45E-04 ND	┺	1.30F-03		474F-04 ND	2	O. CO.
Chloroform M	67-66-3		1.27E-03				1.505-03		٠		1 305.03			2	2
1,1,1 Trichlorosthane H	71:55-6		1.27E-03		461E-04 ND		1 505-03		5.45E-04 ND		1.305.03			2	Q
Carbon Tetrachloride M	56.235	104E03		3.78E-04	7	1.35E-03		4.915-04	7	8.34E-04		304504	ı	1.07E-03	391E-04
Benzene H	71-43-2	B36E-03		3 CME-CD3		1.12E-02		4.09E-03		7.82E-03		2 BEE-03		9 13E-03	3.33E-03
1.2.Dichlorathana "	107-06-2		1.27E-03		- 1		1.50€.03			0	1.30E-03		4.74E-04 ND	QN	NO
Inchlorastnene	9039		1.27E-03				- 38EG3		- t		1.30E-03		4.74E-D4 ND	õ	S
1 Uschloropropene	\$/8-9/		1.27E-03				1.505-03		5.45E-04 ND		1.30E-03	-	_1	S	Q
Tens-1,3-Uchloropropene	970 1970		12750		4 SIE ON NO	1	1995.03		5.45E-04 NO	_	130E.03		4.74E-DN ND	QN	Q
H coulone	10000	81150		2.8E-04	- 1	1.39E.03		5 07E-04		0.005		0.00E+00		7.35E-04	2 69E-04
Cie. Cicnoropropene	3000C		1.77E-03				1.50E-03		5.45E-04 ND		1.30E-03		-1	2	2
1,1 2- Inchloroethans	20062		1.27E-03		- 1	1	1.50E-03		5.45E-04 NC	6	1.305-03		- 1	Q	£
etrachionerhene	127.18.4		127E-03		- 1	1095-03		3.98E-04	- 1		1.30E-03			1 22E-03	4.45E-04
Chlorobenzene	/08901		1.27E-U3		4 61E-OL NO		1.50E-03		5.45E-04 ND		1.30E-03		-	Ş	Ş
Ethyl Benzene ::	100-41-4	6 96E-04		254E-04	2		1.50E-03		5.45E-04 NC	_	1.30E-03		4.74E-04 NO	1.17E-03	4.24E-04
may-yan	0000	200	-	2550		1.00E-03		6.00E-04		305.03		4.74E-04		1535-03	5.58E-04
O-Xylens	9.47.96	OFE		369E-04		9.13E-04		3.33E-04		7.17E-D4		2615-04	1	8 81E-04	3.21E-04
Styrene	100-42-5	5 SEE-UK		2 54E-04			1.50E.C3		- t		305.03		1	1 17E-03	4.24E-04
1,1,2,4:18trachionestrane	6.45.67	UCT SOLO	1.2/5-09	0,000	A STE-OA	000	1.50E-03	00,100,0	5.45E-04 ND	4	1 305 03	80.3000	4.74E-DA ND	Q	Q
Market Control	1.40.70	a concentration	, 20,000	O'METAN	-	n notation		D.UE-100	1			O'WE TO	1	mann	n me
trans.1 2.0 inhiomethere	18.80.6		1 275.00	Ī	A STEP IND		300	T	S COLUMN				D 20	2 2	2
Vinyl Acetale H	10805-4		6.33E.03		1_		7.495-171		H		E STETT			2 5	2 5
2-Butanone (MEK) H	78-53-3	0000		0.005+00	ı	0.00E+00		0.00F+00	1	0.00F+00	3	0.00E+00	L	0.00F+00	n mF+m
Bromodichloromethane	75-27-4		1.27E-03		-		1.50E-03		5.45E-04 ND	Ļ,	1.30E-03		4.74E-D4 ND	Q	QV
4-Methyl-2-pentanone (MIBK) H	108-10-1		6.33E-03				7.49E-03		***		6.51E-03			ON	Q
	591:786		6.335-00		2 30E-03 ND		7 49E-03		2.73E-03 ND		6515-03		2.37E-03 ND	ON	QV
Dipromocnipromethane (Chiorodipromomethane)	124-051		1.27E-03		-1		1.505.03		+		1305-03		- 1	Q	Q
Creat 2. DreMorethane	165.007		275.00		A CHECK		386		5.45E-04 NO		1305-03		A 74E-D4 ND	22	2 2
13-Butadiene n	106-99-0		6 THE AR				7.495.73				654673		2 37F AN NO	2 5	2 5
HAP Total		1,43E 42	2	5.19€ (13	1	1.76E-02	2	6.426.03		1.07 E-02	200	3.895-83	1	1.595.42	6.16E-03
NO. Compound not detected at this detection limit. Compound may be present at a wake less that 6 - Compound present in the laboratory bank gresser/ham repositing limit. Exercise the results are extended to sociated from working page. Q - Exceeds and any and may be assemble of this is the X, subsequence limit was not may.	first. Compound may be present at a value less than the detection limit graves than typologing simple and a value less than the detection limit on the fill fill and with the compound of the	e present at a vi	akte less than t	the detection lim											
J. The associated humanical value is an estimated quantity because the reported concentrations were less than the received described hinds or qualify confinite criteria were not met	reaminy because the	e reported conc.	entrations wen	. test than the r	Toxing detection la	mile or quality Co	animal criteria wa	tre not met	-					T	
W. The analyte was not detected done the reported sample quantiation lend (reporting limit for the analytical multio). However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and prociety measure the enalyte in the sample. The is due to the quality critere not bring met.	sported sample quantistion final (reporting limit for the analytical method). However, the reported quantistion to accurately and practisely measure the enalyte in the sample. This is due to the quelty criteris not being met	ion limit (reportir lly messure the	g limit for the enalyte in the	enalytical metho semple. This is	d) However, the n due to the quality	aported quantital	tion limit is appr met.	oximate and ma	ay or may not rep	E .					
H - This compound is listed as a hazardous air pollut	no dank value with two intes the sampe value. Sample resuk should be considered suspect due to considered population (PAP).	House our same	dwee some		sne considered sust	1000 ol eno 1000	mination.			:		. :			:
	d pollutant concenti	ration greater th	an the detected	d pollutari conce	extration in the exh	aust stream.		÷.	:	:	-	:			
Nate: Compounds analyzed in this pollutent group a	roup are a standard compound target list for the analytical method and ere not necessarily combustion by-products from this angine	pound target list	for the analyti	icel method and	ere not necessarily	combustion by	products from t	his engine.							

Test Report Section 6 Revision 2 June 2002 Page 24 of 36

TABLE 6-11. F119-PW-100 EMISSIONS FACTOR SUMMARY VOLATILE ORGANIC COMPOUNDS (VOCs) Intermediate (Flow by Tracer)

Particle	CASE Number Description	Flow Rate, dectn Anabyte Chloromathans W			/+	-		H			2				
CASS Number Desired De	CASS Numbers Description	Flow Rate, dscfm Analyte Chloronethane ^H													
CAS Number Diversion <	CASS Mumber Difference Differ	Analyte Chloromathans ^H			•	58213		r		-	458213		Ī	Ave	oli e
CACS Number Ortected University Defection University Defection University Defection University Defection CODE-400 CODE-4	CAS Number Defected Underlow C10E403 Underlow <t< th=""><th>Analyte Chloremathana H</th><th></th><th>2</th><th></th><th>1be/1,000</th><th>lbs fuel</th><th>H</th><th>₹</th><th></th><th>15sM 200</th><th>lbs fuel</th><th></th><th></th><th></th></t<>	Analyte Chloremathana H		2		1be/1,000	lbs fuel	H	₹		15sM 200	lbs fuel			
14873 0.00E-0	7.487.3 0.00E-00 1.00E-00 0.00E-00 2.79E-03 0.00E-00 2.79E-03 N.D. 7.487.4 1.26E-03 1.24E-03 1.24E-03 1.24E-03 1.27E-03	Chloromethane H	CAS Number	Detected	Defection	Detected	Detection		Detected	Detection	Detected	Detection			15e/1,000 (b) East
7.6914 2.68C91 2.08C91 NO 279E-03 2.75E-03 NO NO 7.6913 1.28E93 1.28E94 NO 1.28E-03 0.00E-00 2.75E-03 NO NO 7.6913 0.00E-00 2.48E-03 0.00E-00 2.28E-03 0.00E-00 2.75E-03 NO NO 7.5824 0.00E-00 2.48E-03 0.00E-00 2.28E-03 0.00E-00 0.00E-00 <td< td=""><td>76014 2.48E.03 2.48E.03 NO 2.78E.03 2.78E.03 NO 76034 7.5603 7.5864 NO 2.78E.03 ODE-00 2.78E.04 NO 76034 7.5864 0.00E-00 2.45E.04 NO 0.00E-00 2.78E.04 NO 7.5834 0.00E-00 2.45E.04 NO 0.00E-00 2.79E.04 NO 7.5834 0.00E-00 2.45E.04 NO 0.00E-00 2.79E.04 NO 7.5834 0.00E-00 2.45E.03 0.00E-00 2.79E.04 NO 2.79E.04 NO 7.5834 0.00E-00 2.45E.04 NO 0.00E-00 2.79E.03 NO 7.5834 0.00E-00 2.45E.03 NO 2.79E.03 2.75E.04 NO 7.6845 0.00E-00 2.45E.03 NO 2.79E.03 2.75E.04 NO 7.6847 0.00E-00 2.45E.03 NO 2.79E.03 2.75E.04 NO 7.6847 0.00E-00 2.45E.03 NO</td><td></td><td>74-87-3</td><td>0.00E+00</td><td></td><td>0.005+00</td><td></td><td>\vdash</td><td>0000</td><td></td><td>0,005+00</td><td></td><td></td><td></td><td>0.00E+00</td></td<>	76014 2.48E.03 2.48E.03 NO 2.78E.03 2.78E.03 NO 76034 7.5603 7.5864 NO 2.78E.03 ODE-00 2.78E.04 NO 76034 7.5864 0.00E-00 2.45E.04 NO 0.00E-00 2.78E.04 NO 7.5834 0.00E-00 2.45E.04 NO 0.00E-00 2.79E.04 NO 7.5834 0.00E-00 2.45E.04 NO 0.00E-00 2.79E.04 NO 7.5834 0.00E-00 2.45E.03 0.00E-00 2.79E.04 NO 2.79E.04 NO 7.5834 0.00E-00 2.45E.04 NO 0.00E-00 2.79E.03 NO 7.5834 0.00E-00 2.45E.03 NO 2.79E.03 2.75E.04 NO 7.6845 0.00E-00 2.45E.03 NO 2.79E.03 2.75E.04 NO 7.6847 0.00E-00 2.45E.03 NO 2.79E.03 2.75E.04 NO 7.6847 0.00E-00 2.45E.03 NO		74-87-3	0.00E+00		0.005+00		\vdash	0000		0,005+00				0.00E+00
1,4839 1,285-03 1,218-03 <	74839 1128EQ 10 121EQ NO 138EQ 158EQ NO 75834 000E400 2.45EQ NO 000E400 2.78EQ NO 158EQ NO 75834 000E400 2.45EQ NO 000E400 2.78EQ NO 156EQ NO 75834 000E400 2.45EQ NO 000E400 2.78EQ NO 156EQ NO 156EQ NO 75834 000E400 2.46EQ NO 000E400 2.78EQ NO 156EQ NO 156EQ NO 75835 2.86EQ 2.46EQ NO 2.78EQ NO 2.78EQ NO 156EQ NO 75916 2.46EQ 2.46EQ NO 2.78EQ NO 2.78EQ NO 157EQ NO 10.05Q 2.46EQ 000E4Q 2.78EQ NO 2.78EQ NO 157EQ NO 157EQ NO 10.05Q 0.00E4Q 2.48EQ NO 2.78EQ <td>Vinyl Chloride H</td> <td>75-01-4</td> <td></td> <td>2.45E-03</td> <td></td> <td>2.43E-04</td> <td>9</td> <td></td> <td>2.79E-03</td> <td></td> <td>2.76E.04</td> <td>2</td> <td>2</td> <td>2</td>	Vinyl Chloride H	75-01-4		2.45E-03		2.43E-04	9		2.79E-03		2.76E.04	2	2	2
7.6.0.3 1.66.0.3 2.486.0.3 1.086.0.4 NO OTORE-0.0 2.786.0.4 NO NO NO NO 7.5.4.3 0.0000-0.0 2.486.0.3 0.0000-0.0 2.786.0.4 NO 0.0000-0.0 2.786.0.4 NO NO <td>76.033 1.48E-03 NO 2.48E-04 NO 2.48E-04</td> <td>Bromomethene H</td> <td>74-83-9</td> <td></td> <td>1.23E-02</td> <td></td> <td>1</td> <td>9</td> <td></td> <td>1.39E-02</td> <td></td> <td>1.38E-03</td> <td>2</td> <td>9</td> <td>2</td>	76.033 1.48E-03 NO 2.48E-04	Bromomethene H	74-83-9		1.23E-02		1	9		1.39E-02		1.38E-03	2	9	2
758-44 0.00E+00 1.05E+04 0.00E+00 7.05E+04 0.00E+00 7.00E+00 0.00E+00 0.00E+00 7.00E+00 0.00E+00 <	75554 0.00E+00 0.00E+00 0.00E+00 0.00E+00 775E-01 0.00E+00 0.00E+00 775E-01 0.00E+00 0.00E+00 0.00E+00 775E-01 0.00E+00 0.00E+00 0.00E+00 775E-01 0.00E+00	Chloroethane M	75-00-3		2.45E-03			ş		2.795-03		2.76E-04	£	2	£
75-55-4 CARE-01 CARE-01 NO 779E-03 CARE-03 CARE-03 CARE-03 CARE-03 CARE-04 NO CARE-03 CARE-03 CARE-04 NO CARE-03 CARE-04 NO NO CARE-04 NO NO <t< td=""><td>75.54.4 OME-400 OME-400 NO 278-64 NO 778-64 NO</td><td>Freen 11 (Trichlorofluoromethane)</td><td>75-69-4</td><td>0.005+00</td><td></td><td>0.00E+00</td><td></td><td></td><td>0.00€+00</td><td></td><td>0.00E+00</td><td></td><td></td><td>0.005+00</td><td>0.00E+00</td></t<>	75.54.4 OME-400 OME-400 NO 278-64 NO 778-64 NO	Freen 11 (Trichlorofluoromethane)	75-69-4	0.005+00		0.00E+00			0.00€+00		0.00E+00			0.005+00	0.00E+00
75.69.2 0.00E+00 1.00E+00 1.00E+00 0.00E+00	75.69.2 0.00E+00 2.45E-01 0.00E+00 2.45E-01 0.00E+00 2.79E-01 0.00E+00 2.79E-01 0.00E+00 2.79E-01 0.00E+00 0.00E+00 2.79E-01 0.00E+00	1,1-Dichloroethene H	75.35-4		2.45E-03			ş		2.79E-03		2.76E-04	g	S	ş
15.9.4.3 2.48E-03 2.48E-04 NO 5.19E-03 17.9E-04 NO NO 16.456.3 2.48E-03 2.48E-03 2.48E-03 2.48E-03 2.48E-03 1.78E-03	76.9.43 2.48E-03	Mathylane Chloride H	75-09-2	0.00E+00		0.00E+00		-	0000		0.00E+00			0.00E+00	0.00E+00
GF-66-5 2-48E-00 2-48E-00 1-48E-00	GF-65-3 2-45E-03 2-45E-03 1-45E-04 NO 6-45E-03 2-75E-04 NO 2-75E-03 2-75E-04 NO 2-75E-03 2-75E-04 NO 6-57-54 2-35E-03 2-35E-03 2-35E-03 2-35E-03 2-75E-03 2-75E-03 NO 7-1-43-2 6-65E-03 2-35E-03 2-75E-03 NO 2-75E-03 NO 7-90-16 7-7-20-16 2-75E-03 NO 2-75E-03 NO 2-75E-03 NO 7-7-20-16 7-7-20-16 NO 2-75E-03 NO 2-75E-03 NO 7-7-20-16 2-45E-03 2-45E-03 NO 2-75E-03 NO 2-75E-03 NO 1-00-17-16 2-45E-03 2-45E-03 NO 2-75E-03 NO 2-75E-03 NO 1-00-17-16 2-45E-03 2-43E-03 NO 2-75E-03 NO 2-75E-03 NO 1-00-17-16 2-45E-03 2-43E-03 NO 2-75E-03 NO 2-77E-03 NO 2-77E-03 NO	1,1-Dichloroethane H	75-34-3		2.45E-03		2.43E-04	2		2 79E-03		2.76E-04	2	ě	2
71,656 2,65C,03 2,65C,03 NO 2,79C,03 7,79C,03 7,7	71.656 2.45E.03 2.45E.04 NO 2.75E.04 NO 2.75E.04 NO 71.432 5.65E.03 2.45E.03 2.45E.04 NO 7.75E.03 7.77E.03 7.77E.04 NO 71.432 5.65E.03 2.46E.03 2.43E.04 NO 7.75E.03 7.77E.03 7.77E.04 NO 71.60.42 2.46E.03 2.43E.04 NO 2.77E.03 2.77E.04 NO 71.60.43 2.46E.03 2.43E.04 NO 2.77E.03 2.77E.04 NO 1005.03.6 2.46E.03 2.43E.04 NO 2.77E.03 2.77E.04 NO 1005.03.6 2.46E.03 2.43E.04 NO 2.77E.03 2.77EE.04 NO 1005.03.6 2.46E.03 2.43E.04 NO 2.77E.03 2.77EE.04 NO 1005.03.6 2.46E.03 2.43E.04 NO 2.79E.03 2.77EE.04 NO 1005.04.0 2.43E.04 NO 2.79E.03 2.77EE.04 NO 2.79E.03 2.77EE.04 <t< td=""><td>Chloraform H</td><td>67-66-3</td><td></td><td>2.45E-03</td><td></td><td>2.43E-04</td><td>9</td><td>8.64E-04</td><td></td><td>8.54E-05</td><td></td><td>-</td><td>1.665.63</td><td>1.64E-04</td></t<>	Chloraform H	67-66-3		2.45E-03		2.43E-04	9	8.64E-04		8.54E-05		-	1.665.63	1.64E-04
69-205 2.88-CUR 2.38-CUR 1.278-CUR 2.78-CUR ND	96-20-5 2.88-CH 2.378-CH 1.778-CH 2.778-CH 1.778-CH 2.778-CH 1.778-CH 2.778-CH 1.778-CH <	1,1,1-Trichlomethane H	71-556		2.45E-03		I	ş		2 79E-03		2.76E-04	2	Ş	9
17.052 6.00E-03 2.45E-03 1.25E-04 NO 7.75E-03 7.75E-04 NO 1.75E-04 NO NO 1.75E-04 NO NO 1.75E-04 NO NO 1.75E-04 NO NO NO NO 1.75E-04 NO NO NO 1.75E-04 NO NO	11.43.2 6.68/64.0 2.48/64.0 1.48/64.0 1.78/64.0 7.78/64.0 7.78/64.0 1.78/64.0	Carbon Tetrachloride H	56-23-5	2.36E-03		2.336-04		5	2.79E-03		2.76E-04			2.57E-03	2.54E-D4
107-062 107-062 248E-03 248E-03 127-06-04 NO 279E-03 279E-03 NO NO 78-01-6 248E-03 248E-03 248E-03 248E-03 248E-03 248E-03 278E-03 278E-03 NO 10061-01-6 248E-03 248E-03 248E-04 NO 279E-03 278E-04 NO NO 10061-01-6 248E-03 248E-03 248E-04 NO 279E-03 278E-04 NO NO 10061-01-6 248E-03 248E-03 248E-04 NO 279E-03 278E-04 NO NO 1008-02 248E-03 248E-03 248E-04 NO 279E-03 278E-04 NO NO 1008-03 248E-03 248E-03 248E-03 NO 278E-03 NO NO NO 1008-03 248E-03 248E-03 NO 278E-03 NO	107.062 1.07.062 2.48EGG 1.03EGG NO 2.78EGG NO NO 2.78EGG NO 2.78EGG NO NO 2.78EGG NO NO 2.78EGG NO NO NO NO 2.78EGG NO NO NO	Benzene H	71-43-2	6.63E-03		6.56E-04			7.25E-03		7.176-04			6.94E-03	6.86E-04
79016 78016 246EGG 246EGG NO 278EGG NO NO 10051026 246EGG 246EGG 1245EG NO 278EGG NO 278EGG NO 10051026 246EGG 246EGG 246EGG 246EGG 100E40G 278EGG NO 100E40G 10505102 246EGG 246EGG 246EGG 246EGG NO 278EGG NO 100E40G 177054 246EGG 246EGG 246EGG NO 278EGG NO NO 177164 246EGG 246EGG 126EGG NO 278EGG NO NO 177164 246EGG 246EGG 126EGG NO 278EGG NO NO 100647 246EGG 36EGG 246EGG NO 278EGG NO NO 100443 100E40 246EG NO 278EGG NO NO NO 100443 100E40 246EG NO 278EGG NO NO	78016 78016 246EG 246EG 100E40 270EG 100E40 270EG 100E40	1,2-Dichloroethane H	107-06-2		2.456-03		2.43E-04	9		2.79E-03		2.76E-04	S	Q	9
105.61.52 1 246E-03 2.48E-03 2.48E-03 1 248E-03	105.63.6 12.45E.03 12.45E.04 NO 2.73E.03 2.75E.04 NO 105.64.03 2.46E.03 2.46E.03 2.46E.03 2.46E.03 2.46E.03 2.75E.04 NO 2.75E.03 NO 105.65.7 2.46E.03 2.46E.03 2.46E.03 2.46E.03 2.75E.03 NO 2.75E.03 NO 105.65.7 2.46E.03 2.46E.03 2.46E.03 2.46E.03 NO 2.75E.03 2.75E.03 NO 105.65.7 2.46E.03 2.46E.03 2.46E.03 2.46E.03 2.46E.03 2.76E.03 NO 105.65.7 2.46E.03 2.46E.03 2.46E.03 2.46E.03 2.46E.03 2.76E.03 NO 105.65.7 2.46E.03 3.16E.04 NO 2.76E.03 0.00E.00 2.76E.04 NO 105.65.1 2.46E.03 3.16E.04 NO 2.76E.03 NO 2.76E.03 NO 105.65.2 2.46E.03 3.16E.04 NO 2.76E.03 NO 2.76E.03 NO 105.65.	Trichloroethene H	79-01-6		2.45E-03		2.43E-04	9		2.79E-03		2.76E-04	Q	ON	Q
1008-026 1008-026 1,008-026 1008-026 1008-026 1008-026 1008-026 1008-026 1008-026 1008-02	1008-026 1008-026 1008-026 1008-026 1008-026 1008-020 2.48E-03 1008-020 2.78E-03 1008-02 2.78E-03 1008-02 2.78E-03 1008-02 2.78E-03 1008-03	1,2-Dichloropropane H	78-87-5		2.45E-03		····	2		2.79E-03		2.76E-04	2	ð	9
108-843 0.00E-400 1.00E-400 1.00E-400 0.00E-400	108-643 0.00E-40	trans-1,3-Dichloropropene	10061-02-6		2.45E-03		Γ	£		2.79E-03		2.76E-04	Ş	ş	2
10051-01-6 100	1005-01-6 2.48E-03 2.78E-04 NO 2.78E-03 2.78E-04 NO 1004-02 2.48E-03 3.48E-03 2.48E-03 2.48E-03 2.48E-03 2.78E-04 NO 2.78E-03 2.78E-04 NO 1004-02 3.08E-03 3.48E-03 3.48E-03 2.48E-03 2.78E-03 0.00E-03 2.78E-03 NO 1004-05 3.18E-03 3.18E-03 2.48E-03 2.48E-03 2.48E-03 0.00E-03 2.78E-03 NO 1004-05 3.18E-03 3.18E-03 2.48E-03 0.00E-03 2.78E-03 0.00E-03 2.78E-03 NO 1.75E-04 0.00E-03 2.48E-03 0.00E-03 2.48E-03 0.00E-03 2.78E-03 0.00E-03 0.00E-03 1.55E-04 0.00E-03 2.48E-03 0.00E-03 2.78E-03 0.00E-03 2.78E-03 NO 1.55E-04 0.00E-03 2.48E-03 0.00E-03	Toluene H	108-88-3	0.005+00		0.00E+00			0.00E+00		0.00E+00			0.005+00	0.00E+00
1900-6 124EGO 2.48EGO 2.48EGO 2.48EGO 2.48EGO 127EGO ND ND 107516-4 3.88EGO 2.48EGO 1.24EGO 1.24EGO 1.27EGO ND ND 108-97-3 3.88EGO 2.48EGO 1.24EGO 1.06EGO 1.00E-0 1.00E-	1906 2 48EGG 2 48EGG 128EGG 179EGG 179EGG 179EGG 179EGG 179EGG 170EGG 170EGG<	cis-1,3-Dichloropropene H	10061-01-5		2.45E-03		2.43E-04	2		2.795-03		2.76E-04	2	Q	₽
177:184 2.48E-03 2.48E-04 NO 2.78E-03 2.78E-04 NO NO NO 100-04-0 2.48E-03 2.48E-04 2.48E-04 0.00E-00 0	107-154 388E-03 2.48E-04 NO 2.78E-03 NO 105-04 NO 105-	1,1,2-Trichloroethane H	79-00-5		2.45E-03		T	9		2.79E-03		2.76E-04	ð	Q	9
105-50-7 105-50-7	105-95-7 105-96-7 2.45E-73 2.45E-74 NJ 105-96-40 NJ 105-96-7 NJ NJ NJ NJ NJ NJ NJ N	Tetrachloroethene H	127-18-4		2.45E-03		1	Q		2.79E-03		2.76E-04		2	2
100 ct	100 100	Chlorobenzene H	108-90-7		2.45E-03		2.435-04	£		2.79E-03		2.76E-04	2	Ş	2
100-65-0 100-64-0	108-38-3 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 108-476 3.18E-01 3.18E-01 1.0 6.69E-03 2.78E-03 1.0 2.78E-03 1.0 108-476 2.48E-03 2.48E-03 2.48E-04 1.0 2.78E-03 0.00E+00 2.78E-04 NO 15-54-1 0.00E+03 2.48E-03 1.00E+03 2.78E-03 0.00E+03 2.78E-04 NO 15-55-2 1.26E-03 0.00E+03 2.43E-04 NO 2.78E-03 0.00E+03 2.78E-04 NO 16-6-03 1.26E-03 0.00E+03 1.24E-03 NO 2.78E-03 0.00E+03 2.78E-04 NO 16-6-10 1.26E-03 NO 1.28E-03 NO 1.28E-03 NO 1.28E-03 NO 16-6-10 1.28E-03 NO 1.28E-03 NO 1.28E-03 NO 1.28E-03 NO 16-6-10 1.28E-03 NO 1.28E-03 NO 1.28E-03 NO 1.28E-03 <td< td=""><td>Ethyl Benzene H</td><td>100-41-4</td><td>3.68E-03</td><td></td><td>3.64E-04</td><td></td><td></td><td>6.41E-03</td><td></td><td>6.34E-04</td><td></td><td></td><td>5.05E-03</td><td>4.99E-04</td></td<>	Ethyl Benzene H	100-41-4	3.68E-03		3.64E-04			6.41E-03		6.34E-04			5.05E-03	4.99E-04
195-276 319E-07 316E-01 100E-07 100E	195-176 319E-03 319E-04 10 669E-03 662E-04 10 10 10 10 10 10 10	m.p-Xylene H	108-38-3	0.00E+00		0.00E+00			0.00E+00		0.00E+00			0.00E+00	0.00E+00
100.04-5 146E-03 146E-04 10 178E-04	100425 246EGG 243EAG ND 278EGG ND 278EGG ND 278EGG ND 243EAG N	o-Xylene H	95-47-6	3,19E-03		3.16E-04			6.69E-03		6.62E-04			4.94E-03	4.89E-04
75-345 75-64 75-64 70 70 75-64 70 75-64 70 70 75-64 70 70 75-64 70 75-64 70 70 75-64 70 75-64 70 70 75-64 70 70 75-64 70 70 75-64 70 75-64 70 70 75-64 70	75-345 75-64 75-	Styrene H	100-42-5		2.45E-03			2		2.79E-03		2.76E-04	- 1	Q	£
15-54-1 0.00E+00 1.00E+00	100 100	1,1,22-Tetrachloroethane H	79-34-5		2.45E-03			9		2.79E-03		2.75E-04		S	2
75-164 2-45E-03 2-45E-04 NO 2-75E-04 NO NO NO	75-15-0 2-45E-03 2-45E-04 NO 2-79E-04 NO 2-79E-0	Acetone	67-64-1	0.00E+00		0.00E+00		-	0.005+00		0.00E+00			0.00E+00	0.00E+00
155-60-5 156-60-7 151-60-7 100 1	155.625 2.45E-03 2.45E-04 NO 1.35E-04 NO 1.35E-0	Carbon Disulfide H	75-15-0		2.45E-03			旲		2.79E-03		2.76E-04	41441	2	9
138-524 128-524 128-524 128-525 128-	108-054 1,28E-02 1,21E-03 NO 1,39E-03 1,39E-03 NO 78-353 0,005E-00 2,40E-04 NO 2,78E-04 NO 2,78E-04 NO 78-77-4 1,22E-07 1,21E-03 NO 1,38E-03 NO 1,31E-03 NO 108-10:1 1,22E-07 1,21E-03 NO 1,38E-03 NO 1,38E-03 NO 10-7-6-1 1,22E-07 1,21E-03 NO 2,78E-03 1,38E-03 NO 17-6-2 1,22E-07 1,21E-03 NO 2,78E-03 1,38E-03 NO 16-5-2 2,4E-03 2,4E-04 NO 2,78E-03 2,78E-03 NO 16-5-2 2,4E-03 2,4E-04 NO 2,78E-03 2,78E-03 NO 16-5-2 4,17E-03 4,17E-03 2,18E-04 NO 2,78E-03 NO 16-5-3 4,17E-03 1,38E-04 1,44E-03 2,41E-04 NO 16-5-3 2,48E-04 1,44E-03 2,41E-04 NO	trans-1.2-Dichloroethene	156-80-5		2.45E-03		L	오		2.79E-03		2.76E-04	- 1	2	£
78-853 0.00E+00	78-55-3 0.00E+00 2.45E-03 0.00E+00 2.78E-04 NO 2.78E-05 NO 2	Vinyl Acetate **	108-05-4		1.235-02		- 1	2		1.39E-02		1.38E-03		2	9
75-27-4 2.48Ec3 2.48Ev3 0.0 2.78Ev3 2.78Ev3 ND ND	1757.4 2.455.0 1.216.0 NO 1.376.0 NO 1.366.0 NO	2-Butanone (MEK) H	78-53-3	0.00E+00		0.00E+00]	œ	0.00E+00		0.00E+00		- 1	0.006+00	0.00E+00
128-67 128-67 128-67 10 10 10 10 10 10 10 1	108-101 128E42 121E43 ND 138E43 ND 138E43 ND 138E43 ND 138E43 ND 138E43 ND 121E43 ND	Bromodichloromethane	75-27-4		2.45E-03		2.43E-04	g		2.79E-03		2.76E-04	- 1	2	ş
126-02 128-03 128-04 128-04 128-04 10 10 10 10 10 10 10	138-03 128-03 138-03 138-03 138-03 108-03 1	4-Methyt-2-pentanone (MIBK) H	108-10-1		1.23E-02		1,216-03	S		1.39E-02		1.38E-03	. 1	Q	Ş
1246-1 2.48E-0	124-451 2.45E43 2.45E54 ND 2.79E43 2.75E54 ND 75.552 2.45E43 2.45E54 ND 2.79E543 2.75E54 ND 2.75E54	2-Hexanone	591-78-5		1.23E-02		1.215-03	Q		1 39E-02		1.38E-03		2	Q
75-5-2 2.45E-03 2.43E-04 NJ 2.73E-03 2.75E-04 ND NJD 156-392 2.45E-03 2.	15:25.2 2.48E-03 2.48E-04 ND 2.78E-03 2.78E-04 ND 16:590.2 4.17E-03 4.13E-04 4.13E-04 3.44E-03 2.78E-03 4.14E-04 3.78E-03 ND 10:590.0 2.00E-02 4.13E-03 1.38E-03 4.14E-03 3.58E-03 1.58E-03 3.58E-03 3.	Dibromochloromethane (Chlorodibromomethane)	124-48-1		2.45E-03		2.43E-04	£		2.79E-03		2.76E-04		-	ş
196-99-2 2.45E-G3 2.13E-G4 N 2.13E-G3 2.15E-G4 N N N N N N N N N N	165-89.2 2.45E-03 2.43E-04 NO 2.73E-03 2.78E-04 NO 165-89.0 4.17E-03 4.13E-04 1.98E-03 3.44E-03 2.78E-03 3.44E-03 3.4	Bromoform H	75-25-2		2.45E-03		2,435-04	Q		2.79E-03		2.76E-04			£
105-99-0 4.17E-03 4.13E-04 J 4.46E-03 4.41E-04 J 4.22E-03 2.85E-02 2.85E-02 2.85E-02 2.85E-02	105-99-0 4.17E-03 4.17E-04 J. 4.6E-03 4.41E-04 J. 1.00E-02 2.00E-02 1.90E-02 2.80E-02 2.80E-02 2.80E-02	cis-1,2-Dichloroethene	166.59.2		2.45E-03		2.435-04	S		2.79E-03		2.76E-04	2		£
2.00E.02 1.90E.03 2.80E.02 2.81E.03 2.50E.02	2,00E.02 1,99E.03 2,05E.02 2,91E.03	1,3-Butadiene H	106-99-0	4.17E-03		4.13E-04		5	4.46E-03		4.41E-04		7	4.32E-03	4.27E-04
		HAP Total		2.00E.02		1.98E.03		_	2.05E.02		2.81E.03			2.55E.02	2.52E-103

Test Report Section 6 Revision 2 June 2002 Page 25 of 36

TABLE 6-12. F119-PW-100 EMISSIONS FACTOR SUMMARY VOLATILE ORGANIC COMPOUNDS (VOCs) Military (Flow by Tracer)

						Run Number	aber				H		
Flow Rate, dscfm			-	1873476		\dagger			2		Н		
		1	l.A.	100000	No. No. 61	1			8234.76		-	Average	900
			Defection	100	Defection	1	Ē.	Detection	8 <u>5</u>	lbs/1,000 lbs fuel	-	:	
Analyte	CAS Number	Detected	Limit	Detected	Limit		Detected	5	Detected	Limit		Ě	Sal Ond 189
Chloromethane "	74-87-3	0 00E+00		0.00E+00			0.00E+00		0.00E+00		-	0 mF+m	UNF-UN
Vinyl Chloride	75-01-4		3.23E-03		1.73E-04	2		3.625-03		1.94E.04	S	S	Ş
Bromomethane 7	74-83-9		1.616-02		8.67E-04	ð		1,815-02		1	S	2	2
Chloroethane	75-00-3		3.235-03		1.73E-04	QN		3.62E-03		i	Q	S	Ę
reon il (Inchlorolluoromethane)	75-69-4	1.94E-02		1.045-03			2.24E-02		1.215-03		╀	209E-02	1.125-03
1 I-Dichiorathana	75.354		3.23E-03		1.735-04	S		3.62E-03		1.94E-04	2	ş	£
Metnylene Chlonde	75.09.2	0.00E+00		0.00E+00			0.00E+00		0.005+00		-	0.00E+00	0.005+00
- I-Dichlordenane	75.34.3		3.23E-03		1.735.04	Ð		3.62E-03		1.94E-04	Q	2	£
- Elifornia	67.88-3		3.23E-03		1,735-04	ą		3.62E-03		1.94E-04	₽	2	Ð
1 1 1 Inchioroghane	71.556		3.23E-03		1.73E-04	2		3.62E-03			ş	£	Ð
Carbon letrachlonde "	56-73-5	2 62E-03		1415-04		-	3.405-03		1 83E-04	1	L	301E-03	1625-04
Denzene	71-43-2	1.13E-02		6.07E-04			6.88E-03		3.70E-04		6	9.09E-03	4.BBE-04
1.2-Dichioroethane	107-06-2		3.23E-03			₽		3.62E-03		1.94E-04		2	₽
Inchloroethene	79-01-6		3 23E-03		7	Q		3.62E-03		1.94E-04	2	S	Ð
1 Z-Dichloropropane	78-87-5		3.23E-03			Q		3.625-03		1.946-04	9	ş	9
trans-1 3-Dichloropropene	10061-02-6		3.23E-03		1.73E-04	Q		3.62E-03		1.94E-04	£	ş	Q
f ensuloT	108-86-3	0.00E+00		0.00E+00			0.00E+00		0:00E+00		0	0.00E+00	0.00E+00
Cis-1,3-Dichloropropene	10061-01-5		3.23E-03		1,736-04	QN		3.62E-03		1.94E.04	₽	9	Ş
1,1,2-Trichloroethane	79-00-5		3.23E-03		1.735-04	QN		3.62E-03			S	ş	9
Tetrachloroethene T	127-18-4		3 23E-03		1.73E-04	ON		3.62E-03		1.94E-04	S	Ş	2
Chlorobenzene	108-90-7		3.23E-03		1.73E-04	QN		3.62E-03		1.94E.04	₽	2	Ð
Ethyl Benzene "	19.61	3.16E-03		1.70E-04		ı		3.62E-03			⊢	3.395-03	1.82E-04
m.p-Xylene	108:36:3	7.75E-03		4.15E-04		_		3.62E-03		1.94E-04	S S	5.68E-03	3.05E-04
O-Xylene "	95-47-6	2.65E-03		1.42E-04				3.62E-03		1.94E-04	L	3.13E-03	1.685-04
Slyrene	100-42-5		3.23E-03			QN		3.62E-03		1	QN.	Ð	S
1,1 2 2 retrachloroethane "	79.34-5	1000	3.23E-03		1.736-04	₽		3.62E-03		1.94E-04	Q	Q	S
Course Names H	179-75	U.O. T		0.005+00		- -	0.005+00		0.005+000		ō	0.00E+00	0.00E+00
trans.1 2. Dirthorathan	269	1.235403	3 25 00	P SAL-TO		4	1.38E-03	100000	7.395.05		4	1.30E-03	6.99E-05
T estate Vani	2 20 00		3,235-03		Ŧ	2 !		362E-U3		- 1	2	₽	9
2-Butanone MEKO H	78.02.3	0073000	1.015-02	00,000	9.5/ 544	2 0	200	1.815-02	20.100	972504	+	2	2
Bromodichloromethane	75-27-4	200	3 73E.03	0.005	1735.04	+	0.00=400	3 575 77	n n n n	70707	2 <u>9</u>	B	0.005+00
4-Methyl-2-pentanone (MIBK) H	108-10-1		1615.00		1	2 5		1 815.00		4	2 9		2 2
2-Hexanone	591-78-6		1.615-02		1	Į Į		1.815-02		9775-04	2 5	2 2	2 5
Dibromochloromethane (Chlorodibromomethane)	124-48-1		3.23E-03		1	Q Q		3.62E-03		1 .	2	S	2
Bromoform #	75-25-2		3.23E-03			Q		3.62E-03		1 94E-04	g	₽	Q
CIS-1 Z-Dichloroginens	156-59-2		3.23E-03		†	2		3.62E-03		····t	Ц	Q	QV
HAD Tatal	TRAME.	2 675 03	1.615-02	4645 00	8.67E-04	3	20.00	1.81E-02		9.72E-04	3	71E-02	9.20E-04
ND - Compound not detected at this detection limit. Compound may be present at a value less than the detection limit. B - Compound present in the laboratory blank greater than reporting limit.	Compound may b	Za/Euz present at a v it.	alue fess than	1.54E.03	ŧ		1.17E.02		6.26E.04		-	4.27E-02	2.30E.03
E. Results are estimated, value reported is outside linear working range. O. Exceeding againty, could milks, (An assimplie of this is the % spike recovery limit was not met.) The second and unusered value is estimated.	linear working rang his is the % spike n	scovery limit wa	s not met.)										
U. The analyse was confedented sample quantitation finit (specific finite for analyse was not defined for the analyse was not deficited down the apprinted sample quantitation finit is analyse was not deficited down the apprinted sample quantitation finit is analyse was not deficited down finit is approximate and make armay not represent	d sample quantitat	on limit (reporti	entrations were	analytical meth	required dated od). However,	the rep	is or quality of	confroi critera Ition firmit is a	were not met	may or may no	represe	ŧ	
the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample. This is due to the quality critical not being met.	urately and precise	ly measure the	analyte in the	sample. This i	s due to the q	uality cm	lena nol bein	g met.					
H - This compound is listed as a hazardous air pollutant (HAP).	tant (HAP).		value. Oamp	e resun snoule	DB COUSIGEUS	ensbec	l due to cont	amination.					
Poerite representation (M. C. L.					•								
where the second	n politicant concent	ation greater th	an the detected	d poliutant con	centration in th	e exhau	st stream.						
to the state of the season of the state of t		מחתות ופולפי יים	TOL THE SHALL	CEI MEINOG GAL	3 are not neces	Saniy C	ombustion o	P. products mor	n this engine.				

Test Report Section 6 Revision 2 June 2002 Page 26 of 36

EMISSIONS FACTOR SUMMARY ALDEHYDE/KETONES **SLIPSTREAM DUCT** (Flow by Tracer) TABLE 6-13. F119-PW-100

•										Engla	Engine Mode								- 1
				-				Appr	Approach			Inte	Intermediate			-	Milkery		
Flow Rate, dscfm			7	50692				289299	285			1	1458213				1823426		
		J. I.P.	٠	lbs/1,000	lbs fuel	L	P.P.	-	lbs/1,000 lbs fuel	is fuel	4	J-LF4	lbs/1,000 lbs fuel	lbs fue!	_	lb/hr	lbs/1,000 lbs fuel	lbs fuel	
			Detection		Detection		Ó	Jetection		Detection		Detection		Detection		Detection		Detection	
Analyte	CAS Number	Detected	Limit	Detected	Ē.	å	Detected	Ç	Detected	Ē	Detected	E.	Detected	Ľ	Detected	Limit	Detected	Limit	
Formaldehyde H	90000	1.37E+00		9.98E-01		97	9.75E-02		3.56E-02		2.47E-01		2.45E-02		1.415-01		7.595-03		-
Acetaldehyde H	0-20-52	1.535-01		1,115-01		- B	.BSE-02		6.76E-03		2.64E-02		2.61E-03		J 1.55E-02		8.31E-04		-
Acrolein H	107-02-8	4.96E-02		3.60E-02		-,		3.65E-02	-	1.33E-02 W		1.65E-02		1.63E-03 W	3	3.44E-02		1.85E-03 W	m
Acetone	1-19-79	3.21E-01		2.33E-01		1.1	1.17E+00		4.27E-01	7	6.26E-01		6.20E-02		J 9.93E-01		5.33E-02		_
Propanal	123-38-6	2.21E-02		1.615-02				3.66E-02		1.33E-02 W	50-368-G		9.78E-04		J 7.64E-03		4.10E-04		٦
Crotonaldehyde	4170-30-3	3.66E-02		2.665-02		<u> </u>		3.66E-02		1.33E-02 W		1.655.02		1.83E.03 W	m	3.44E-02		1.85E-03	3
Isobutyraldehyde / Methyl Ethyl Ketone H	78-93-3	9.16E-02		6.65E-02		-,	E	3.86E-02		1.33E-02 W		1.655-02		1.635-03	В	3.44E-02		1 85E-03	3
Benzaldehyde	100-52-7	5.72E-02		4.16E-02		-	F	3.66E-02		1.33E-02 W		165E-02		1.635-03	з	3.44E-02		1.85E-03 (3
Isopentanal (Isovaleraldehyde)	590-96-3		6.49E-02		4.71E-02	3		3.66E-02		1.33E-02 W		1.65E-02		1.63E-03	3	3.44E-02		1.85E-03	3
Pentanal (Valeraldshyds)	110-62-3		6.49E-02		4.71E-02 L			3.66E-02		1.33E-02 W	_	1.65E-02		1.63E-03	a	3.44E-02		1.85E-03	3
o-Tolualdehyde	529-20-4	3.625-02		2.77E-02		-	E.	3.66E-02		1.33E-02 W		1.65E-02		1.63E-03	W 8.02E-03		4.31E-04		~
m,p-Tolualdehyde	620-23-5	2.63E-02		1.91E-02	 	-	Ē	3.86E-02		1.33E-02 W	1,195-02		1.17E-03		J 3.05E-03		1.54E-04		اد
Hexanal (Hexaldehyde)	104-87-0		6.49E-02		4.71E-02	3		3.66E-02		1.33E-02 W		1.65E-02		1.63E-03	m	3.44E-02		1.86E-03 U.	3
HAP Total		1.67E+00		1.21E+00		=	1.16E-D1		4.24E-02		2.74E.01		2,71E-02		1.57E.01		8.42E.03		-
																		:	
N.). Compared to factorize the detection limit. Compared may be present at a called lack than the	THE PERSON NAMED IN	TOOUR DE NOW	And division of the A		-				-										

NO - Compound not detected at this detection limit. Compound may be present at a value less than the detection limit.
A. The associated numerical value is accepted. Procedures from which value was obtained meets the quality control criteria as defined by the DQAP.

E - Results are estimated, value reported is cudeigle linear working range.

O - Exceeds quality control limits. (An example of this is the second with was not med.)

O - Exceeds quality control limits, to describe the reported concentrations were less than the required detection limits or quality control control was not med.

W. The analyse was not detected above the reported sample quantitation limit (eporting limit for the analytical method). However, the reported quantitation limit is approximate and may or may not represent

the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample. This is due to the quality criteria not being met.

bb. The sample media blank and/or sample field blank value with two times the sample value. Sample result should be considered suspect due to contamination.

H. This compound is listed as a hazardous air pollutant (HAP):

Results reported as 0.00 indicate a detected ambient policitant concentration greater than the detected polution concentration in the exhaust stream.

Note: Compounds analyzed in this pollutant group are a standard compound target list for the analytical method and are not necessarily combustion by products from this engine.

Test Report Section 6 Revision 2 June 2002 Page 27 of 36

TABLE 6-14. F119-PW-100 EMISSIONS FACTOR SUMMARY ENGINE RAKE BENZENE (Flow by Carbon Balance)

THE REPORT OF THE PART OF THE			The Man Man	Mode	ander of state and manufactures and state and	
The second secon				MOME		T
		ldle	6	Ap	Approach	
Flow Rate, dscfm		39646	46	2	71633	
			000' 1/sq1		lbs/1,000	
Analyte	lb/hr		lbs fuel	lb/hr	len tuel	
Benzene	1.66E-01		1.21E-01	8.31E-03	3.03E-03	
			1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			
ND - Compound not detected. Value is the method detection limit.	method detec	tion limi				
A - The associated numerical value is accepted. Procedures from which	ted. Procedu	ires from	າ which			
value was obtained meets the quality control criteria as defined by the DQAP.	ntrol criteria a	is define	id by the DQAP.	11160 1170 1270 1270 1270 1270 1270 1270 127	AND THE RESERVENCE OF THE PROPERTY OF THE PROP	
B - Compound present in the laboratory blank greater than reporting limit.	k greater thar	reportii	ng limit.	The control of the co		
E - Results are estimated, value reported is outside linear working range.	outside linear	working	range.			
Q - Exceeds quality control limits.						
J - The associated numerical value is an estimated quantity because the reported	mated quantil	ty becau	use the reported			
concentrations were less than the required, detection limits or quality control criteria were not met.	d, detection l	imits or	quality control crite	ria were not met.		
UJ - The analyte was not detected above the reported sample quantitation limit. However,	reported sam	nple qua	ntitation limit. How	ever,		
the reported quantitation limit is approximate and may or may not represent the actual limit	mate and ma	y or ma	y not represent the	actual limit		
of quantitation necessary to accurately and precisely measure the analyte in the sample.	and precisely	measur	e the analyte in the	sample.		
This is due to the quality criteria not being meet.	ng meet.					
bb - The sample media blank and/or sample field blank value with two times the sample value.	field blank val	lue with	two times the samp	ile value.		
Sample result should be considered suspect due to contamination.	spect due to c	contami	nation.			
						i

Test Report Section 6 Revision 2 June 2002 Page 28 of 36

F119-PW-100 EMISSIONS FACTOR SUMMARY ENGINE RAKE ALDEHYDE/KETONES (Flow by Carbon Balance	
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The Mate, discrim	THE PERSON NAMED AND PARTY OF THE PE		Engine	Engine Mode		
Filew Rate, discrim 39646 71633 71633 71633 71633 71633 71633 71633 71633 71633 71633 71634 7164 7			Idle	A	pproach	
Analyte Incrementation lbs/n (DDD Incrementation lbs/n (DDD Incrementation lbs/n (DDE-DD Incrementation lbs/n (DDE-DD Incrementation lbs/n (DDE-DD Incrementation	Flow Rate, dscfm		39646		71633	
Particle Particle			lbs/1,000		000,1/sdl	
Comparison Com	Analyte	lb/hr	lbs fuel	lb/hr	lbs fuel .	
Acetaldehyde	Formaldehyde	1.78E+00	1.29E+00	1.40E-01	5.09E-02	
Actrolen Actrolen 0.00E+00 0.00E+00 0.00E+00 Actrolen 4.50E-01 1.40E-01 5.00E-03 5.00E-03 Programal 1.69E-01 1.40E-03 5.50E-03 3.00E-03 Programal Programs 1.60E-02 1.19E-02 3.71E-03 2.70E-03 Bonzaldshyde 1.35E-01 9.81E-02 3.71E-02 3.70E-02 3.70E-03 Pentanal Valeraldehyde 1.05E-01 9.81E-02 1.70E-02 0.70E-02 0.70E-03 3.70E-03 Pentanal Valeraldehyde 1.05E-01 2.70E-02 0.70E-02 0.70E-02 0.70E-03	Acetaldehyde			***********	l	
Acetone 1 (1900)	Acrolein	0.00E+00	0.00€+00	0.00E+00	0.00E+00	
Cotronaldehyde Methyl Ethyl Ketone 1.68E-01 1.19E-02 1.74E-03 2.70E-03 2.70E-03	Acetone	1.63E-01	1.19E-01	1.40E-02	5.09E-03	
Continuation Compound not detected Value is the method detection limit.	Propanal		*******	2.25E-02 J	8.23E-03 J	manded of manded investment of the control of the c
Sebutyraidehyde / Methyl Ethyl Ketone C 119E-01 918E-02 133E-02 133E-03 133E-03 135E-03	Crotonaldehyde	1.63E-02	1.19E-02 J	7.41E-03	2.70E-03	
Benzaldehyde 13E-01 981E-02 118E-02 4.31E-03	_		8.63E-02	1.93E-02 J	7.05E-03 J	
Soperatanal (sovaleraldehyde)	Benzaldehyde	1.35E-01	9.81E-02	1.18E-02	4.31E-03	
Pentanal (Valeraldehyde)	Isopentanal (Isovaleraldehyde)			2.68E-03 U	9.79E-04 U	Control of the state of the sta
o-Tolualdehyde 1.05E-01 7.66E-02 3.11E-03 1.14E-03 mp-Tolualdehyde 6.09E-02 4.53E-02 9.34E-03 3.41E-03 Hexanal (Hexaldehyde) 6.09E-02 4.42E-02 3.97E-03 1.45E-03 ND - Compound not detected. Value is the method detection limit. A - The associated numerical value is accepted. Procedures from which value was obtained meets the quality control criteria as defined by the DOAP. A - The associated numerical value is an estimated quartity because the reported. A - The associated numerical value is an estimated quartity because the reported. A - The associated numerical value is an estimated quartity because the reported. A - The associated numerical value is an estimated quartity because the reported. A - The associated numerical value is an estimated quartity because the reported. A - The associated numerical value is an estimated quartity because the reported quantitation limit. A - The associated numerical value is an estimated quartity because the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation mecessary to accurately and precisely measure the analyte in the sample. A - The sample media blank and/or sample field blank value with two times the sample value. A - The sample media blank and/or sample field blank value with two times the sample value. A - The sample result should be considered subjected amplient pollutant concentration greater than the detected pollutant in or contamination of a mind sobutyrial beyone result in overlapping peaks during	Pentanal (Valeraldehyde)		2.70E-02 U	2.15E-03 J	7.83E-04 J	The symmetry date of defect the symmetry of the symmetry process are a majority of and
m.p.Tolualdehyde Hexanal (Hexaldehyde) B. 624E-02 Hexanal (Hexaldehyde) ND - Compound not detected. Value is the method detection limit. A. The associated numerical value is accepted. Procedures from which value was obtained meets the quality control criteria as defined by the DQAP. B. Compound present in the laboratory blank greater than reporting limit. E. Results are estimated, value reported is outside linear working range. G. Execost quality control limits. J. The associated numerical value is an estimated quantity because the reported concentrations were less than the required, detection limits or quality control criteria were not met. U. The analyte was not detected above the reported sample quantitation limit is approximate and may or may not represent the actual limit of quantitation increasary to accurately and precisely measure the analyte in the sample. This is due to the quality criteria not being meet. Bo The sample media blank and/or sample field blank value with two times the sample value. Sample result should be considered suspect due to contamination. Sample result should be considered suspect due to contamination and is single compound. Result compound or combination of both. C-Analytical "peaks" weeting determination of a single compound. Result could be either compound or combination of poth.	o-Tolualdehyde	1.05E-01	7.66E-02	3.11E-03	1.14E-03	
Hexanal (Hexaldehyde) Hexanal (Hexaldehyde) ND - Compound not detected. Value is the method detection limit. ND - Compound not detected. Value is the method detection limit. ND - Compound present in the laboratory blank greater than reporting limit. E. Results are estimated, value reported is outside linear working range. O - Exceeds quality control limits. Jo - The associated numerical value les an estimated quantity because the reported concentrations were less than the required, detection limits or quality control criteria were not may or may not represent the actual limit the reported quantitation in mit is approximate and may or may not represent the actual limit of quantitation in mit is approximate and may or may not represent the sample. This is due to the quality criteria not being meet. Db - The sample media blank and/or sample field blank value with two times the sample value. Sample result should be considered suspect due to contamination. Results reported as 0.00 indicate a detected ambient pollutart concentration greater than the detected pollutant in the exhaust stream. Results are signed to both. C-Analytical "beaks" overlab pring preventing determination of a single commonund. Riskutt could be either compound or combination of both.	m.p-Tolualdehyde	6.24E-02	4.53E-02	9.34E-03	3.41E-03	
ND - Compound not detected. Value is the method detection limit. A - The associated numerical value is accepted. Procedures from which value was obtained meets the quality control criteria as defined by the DQAP. B - Compound present in the laboratory blank greater than reporting limit. E - Results are estimated, value reported is outside linear working range. C - Exceeds quality control limits. J - The associated numerical value is an estimated quantity because the reported concentrations were less than the reported guantity because the reported concentrations were less than the reported above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation limit is approximate and may or may not represent the sample. This is due to the quality criteria not being meet. By - The sample media blank and/or sample field blank value with two times the sample value. Sample result should be considered subject due to contamination. Results reported as 0 00 indicate a detected ambient pollutant concentration greater than the detected pollutant in the exhaust stream. MEK and isobutyraldehyde result in overlapping peaks during analysis. Result could be either combound or combination of both.	Hexanal (Hexaldehyde)	6.09E-02	4.42E-02	3.97E-03	1.45E-03	
ND - Compound not detected. Value is the method detection limit. A- The associated numerical value is accepted. Procedures from which value was obtained meets the quality control criteria as defined by the DQAP. B- Compound present in the laboratory blank greater than reporting limit. E- Results are estimated, value reported is outside linear working range. Q - Exceeds quality control limits. U- The associated numerical value is an estimated quantity because the reported concentrations were less than the required, detection limits or quality control criteria were not met. UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation in mit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample. This is due to the quality criteria not being meet. Db - The sample media blank and/or sample field blank value with two times the sample value. Sample result should be considered suspect due to contamination. Results reported as 0.00 indicate a detected ambient pollurant concentration greater than the detected pollurant in the exhaust stream. Results and isobutyradehyde result in overlapping peaks during analysis. Result could be either compound or combination of both.	The state of the s	To the second se				
A - The associated numerical value is accepted. Procedures from which value was obtained meets the quality control criteria as defined by the DQAP. B - Compound present in the laboratory blank greater than reporting limit. E - Results are estimated, value reported is outside linear working range. O - Exceeds quality control limits. J - The associated numerical value is an estimated quantity because the reported concentrations were less than the required, detection limits or quality control criteria were not the reported above the reported sample quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample. This is due to the quality criteria not being meet. This is due to the quality criteria not being meet. Db - The sample media blank and/or sample field blank value with two times the sample value. Sample result should be considered suspect due to contamination greater than the detected pollutant in the exhaust stream. Results reported as 0.00 indicate a detected ambient pollutant concentration greater than the detected pollutant in of both. Results reported as 0.00 indicate a detected ambient pollutant concentration greater than the detected pollutant of both. Afficial "beaks" evely accompaning determination of a single compound. Result cound be either compound or combination of both.	ND - Compound not detected. Value is the	method detection lim	The same that th	The second secon	MATERIAL MATERIAL MATERIAL MATERIAL MATERIAL STREET STREET STREET STREET STREET STREET STREET STREET	andement attended to be desired the characteristics of construction of the constructio
Percompound present in the laboratory blank greater than reporting limit. E - Results are estimated, value reported is outside linear working range. G - Exceeds quality control limits. J - The associated numerical value is an estimated quantity because the reported concentrations were less than the required, detection limits concentration was not detected above the reported sample quantitation limit. However, UL - The analyte was not detected above the reported sample quantitation limit is approximate and may or may not represent the actual limit of quantitation more cessary to accurately and precisely measure the analyte in the sample. This is due to the quality criteria not being meet. The sample media blank and/or sample field blank value with two times the sample value. Sample result should be considered suspect due to contamination. Results reported as 0.00 indicate a detected ambient pollutant concentration greater than the detected pollutant in the exhaust stream. Results reported as 0.00 indicate a detected ambient pollutant concentration greater than the detected pollutant in the exhaust stream. Results reported as 0.00 indicate a detected ambient pollutant concentration greater than the detected pollutant in the exhaust stream. Alexand isobutyraldehyde result in overlapping peaks during analysis. Result could be either compound or combination of both.	A - The associated numerical value is accep	ted. Procedures fron	n which			
B - Compound present in the laboratory blank greater than reporting limit. E - Results are estimated, value reported is outside linear working range. O - Exceeds quality control limits. J - The associated numerical value is an estimated quantity because the reported concentrations were less than the required, detection limits or quality control criteria were not met. UJ - The analyte was not detected above the reported sample quantitation limit. However, the analyte was not detected above the reported sample quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample. This is due to the quality criteria not being meet. Bb - The sample media blank and/or sample field blank value with two times the sample value. Sample result should be considered suspect due to contamination. Results reported as 0.00 indicate a detected ambient pollutant concentration greater than the detected pollutant in the exhaust stream. Results reported as 0.00 indicate a detected ambient pollutant concentration greater than the detected pollutant in overlapping peaks during analysis. Result could be either compound or combination of both.	value was obtained meets the quality co	ntrol criteria as defin	ed by the DQAP.			
E - Results are estimated, value reported is outside linear working range. O - Exceeds quality control limits. J - The associated numerical value is an estimated quantity because the reported concentrations were less than the required, detection limits or quality control criteria were not met. UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample. This is due to the quality criteria not being meet. bb - The sample media blank and/or sample field blank value with two times the sample value. Sample result should be considered suspect due to contamination. Sample result should be adtected ambient pollutant concentration greater than the detected pollutant in the exhaust stream. MEK and isobutyraldehyde result in overlapping peaks during analysis. Result could be either compound or combination of both.	B - Compound present in the laboratory blan	k greater than reporti	ng limit.			
O - Exceeds quality control limits. J - The associated numerical value is an estimated quantity because the reported concentrations were less than the required, detection limits or quality control criteria were not met. UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample. This is due to the quality criteria not being meet. Bb - The sample media blank and/or sample field blank value with two times the sample value. Sample result should be considered suspect due to contamination. Sample result should be considered ambient pollutant concentration greater than the detected pollutant in the exhaust stream. MEK and isobutyraldehyde result in overlapping peaks during analysis. Result could be either compound or combination of both.	E - Results are estimated, value reported is	outside linear workin	j range.			
 J - The associated numerical value is an estimated quantity because the reported concentrations were less than the required, detection limits or quality control criteria were not met. UJ - The analyte was not detected above the reported sample quantitation limit is approximate and may or may not represent the actual limit of quantitation limit is approximate and may or may not represent the sample. This is due to the quality criteria not being meet. Bb - The sample media blank and/or sample field blank value with two times the sample value. Sample result should be considered suspect due to contamination. Results reported as 0.00 indicate a detected ambient pollutant concentration greater than the detected pollutant in the exhaust stream. C- Analytical "beaks" overlap preventing determination of a single compound. Result could be either compound or combination of both. 	Q - Exceeds quality control limits.				•	
Concentrations were less than the required, detection limits or quality control criteria were not met. UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample. This is due to the quality criteria not being meet. By - The sample media blank and/or sample field blank value with two times the sample value. Sample result should be considered suspect due to contamination. Results reported as 0.00 indicate a detected ambient pollutant concentration greater than the detected pollutant in the exhaust stream. MEK and isobutyraldehyde result in overlapping peaks during analysis. Result could be either compound or combination of both.	J - The associated numerical value is an esti	imated quantity beca	use the reported			
UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample. This is due to the quality criteria not being meet. By - The sample media blank and/or sample field blank value with two times the sample value. Sample result should be considered suspect due to contamination. Results reported as 0.00 indicate a detected ambient pollutant concentration greater than the detected pollutant in the exhaust stream. MEK and isobutyraldehyde result in overlapping peaks during analysis. Result could be either compound or combination of both.	concentrations were less than the require	ed, detection limits or	quality control criteria	a were not met.		
the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample. This is due to the quality criteria not being meet. bb - The sample media blank and/or sample field blank value with two times the sample value. Sample result should be considered suspect due to contamination. Results reported as 0.00 indicate a detected ambient pollutant concentration greater than the detected pollutant in the exhaust stream. MEK and isobutyraldehyde result in overlapping peaks during analysis. Result could be either compound or combination of both.	UJ - The analyte was not detected above the	reported sample qua	intitation fimit. Howev	rer,		lare has near
of quantitation necessary to accurately and precisely measure the analyte in the sample. This is due to the quality criteria not being meet. bb - The sample media blank and/or sample field blank value with two times the sample value. Sample result should be considered suspect due to contamination. Results reported as 0.00 indicate a detected ambient pollutant concentration greater than the detected pollutant in the exhaust stream. MEK and isobutyraldehyde result in overlapping peaks during analysis. Result could be either compound or combination of both.	the reported quantitation limit is approxi	imate and may or ma	y not represent the ac	stual limit		
This is due to the quality criteria not being meet. bb - The sample media blank and/or sample field blank value with two times the sample value. Sample result should be considered suspect due to contamination. Results reported as 0.00 indicate a detected ambient pollutant concentration greater than the detected pollutant in the exhaust stream. MEK and isobutyraldehyde result in overlapping peaks during analysis. Result could be either compound or combination of both. c- Analytical "beaks" overlap preventing determination of a single combound. Result could be either compound or combination of both.	of quantitation necessary to accurately a	and precisely measur	e the analyte in the s	ample.		
bb - The sample media blank and/or sample field blank value with two times the sample value. Sample result should be considered suspect due to contamination. Results reported as 0.00 indicate a detected ambient pollutant concentration greater than the detected pollutant in the exhaust stream. MEK and isobutyraldehyde result in overlapping peaks during analysis. Result could be either compound or combination of both. c- Analytical "beaks" overlap preventing determination of a single compound. Result could be either compound or combination of both.	This is due to the quality criteria not bein	ng meet.				
Sample result should be considered suspect due to contamination. Results reported as 0.00 indicate a detected ambient pollutant concentration greater than the detected pollutant in the exhaust stream. MEK and isobutyraldehyde result in overlapping peaks during analysis. Result could be either compound or combination of both. c- Analytical "peaks" overlap preventing determination of a single compound. Result could be either compound or combination of both.	bb - The sample media blank and/or sample	field blank value with	two times the sample	e value.		
Results reported as 0.00 indicate a detected ambient pollutant concentration greater than the detected pollutant in the exhaust stream. MEK and isobutyraldehyde result in overlapping peaks during analysis. Result could be either compound or combination of both. c- Analytical "beaks" overlap preventing determination of a single compound. Result could be either compound or combination of both.	Sample result should be considered sur	spect due to contami	nation.			
MEK and isobutyraldehyde result in overlapping peaks during analysis. Result could be either compound or combination of both. c- Analytical "beaks" overlap preventing determination of a single combound. Result could be either compound or combination of both.	Results reported as 0.00 indicate a detected	l ambient pollutant co	ncentration greater th	an the detected p	ollutant in the exhaust str	eam.
c- Analytical "peaks" overlap preventing determination of a single combound. Result could be either compound or combination of both.	MEK and isobutyraldehyde result in overlapp	ing peaks during ana	lysis. Result could b	e either compoun	d or combination of both.	
	c- Analytical "peaks" overlap preventing dete	ermination of a single	compound. Result co	uld he either com	nound or combination of b	nth

Test Report Section 6 Revision 2 June 2002 Page 29 of 36

TABLE 6-16. F119-PW-100 SLIPSTREAM RAKE INTAKE SAMPLE POINT DATA COMPARISON

the first annual constitution of the second	p	idle	Аррг	Approach	Intermediate	ediate		Military
Sample	(""", 05	ı	•	ı,		i c		
Foint	് വ (ppm)	SF6 (ppm)		SFe (ppm)	CO (ppm) Ste (ppm) NOX (ppm) Ste (ppm) NOX (ppm)	SFe (ppm)	NOX (ppm)	SFe (ppm)
1	53.0	0.265	8.5	0.104	11.0	0.102	29.5	0.097
2	53.5	0.259	8.5	0.107	10.0	0.104	30.0	0.086
3	52.5	0.260	6	0.111	11.0	0.104	32.0	0.084
4	58.0	0.249	6	0.109	12.0	0.103	36.5	0.083
5	60.0	0.247	6	0.108	12.0	0.103	37.5	0.084
9	62.0	0.249	6	0.109	12.0	0.103	37.0	0.083
7	54.0	0.250	8	0.109	10.0	0.107	30.0	0.085
8	53.0	0.255	8.5	0.112	10.0	0.105	30.0	0.086
6	54.5	0.248	8.5	0.112	10.0	0.106	32.0	0.083
10	54.0	0.245	8.5	0.109	10.0	0.105	34.0	0.079
11	49.5	0.234	8	0.107	10.0	0.103	32.0	0.080
12	47.5	0.239	8.5	0.107	10.0	0.103	31.5	0.077
Maximum	62.0	0.265	9.0	0.112	12.0	0.107	37.5	0.097
Minimum	47.5	0.234	8.0	0.104	10.0	0.102	29.5	0.077

Test Report Section 6 Revision 2 June 2002 Page 30 of 36

TABLE 6-17. F119-PW-100 EMISSIONS FACTOR SUMMARY PARTICULATES Idle (Flow by Tracer)

татай саван амайдар, февер доста-оба в ест сев у перей в есть, сеп д амайдарам, повыйства та сев се сев сев се			Run Number	Run Number				
	,		,	7	E		Ave	Average
Flow Rate, dscfm	288	289029	289	289029	289029	621		
		1/sq1		1/sql		lbs/1,000		lbs/1,000
Analyte	lb/hr	lbs fuel	lb/hr	lbs fuel	lb/hr	lps fuel	lb/hr	lbs fuel
Particulate (total)	3.999	2.904	3.216	2.336	3.082	2.238	3.433	2.493

TABLE 6-18.
F119-PW-100
EMISSIONS FACTOR SUMMARY
PARTICLES
Approach
(Flow by Tracer)

Runkumber		Ru	Run Number		AND THE PERSON OF THE PERSON O	The state of the s		
	-		. 3	ī	3		Ave	lverage
Flow Rate, dscfm	663582		599	963582	663582	82		
		lbs/1,000		000' 1/sql		lbs/1,000		lbs/1,000
Analyte	lb/hr	lbs fuel	lb/hr	lbs fuel	lb/hr	lbs fuel	lb/hr	lps fuel
Total Particulate	4.339	1.580	8.242	3.001	3.894	1.418	5.492	2.000

Test Report Section 6 Revision 2 June 2002 Page 31 of 36

Test Report Section 6 Revision 2 June 2002 Page 32 of 36

Run Number		Run N	Run Number			
				7	Ave	Average
Flow Rate, dscfm	1456	458213	1456	458213		
		000' L/sql		lbs/1,000		lbs/1,000
Analyte	lb/hr	lbs fuel	lb/hr	lbs fuel	lb/hr	lbs fuel
Particulate (total)	15.091	1.493	13.387	1.324	14.239	1.408

Test Report Section 6 Revision 2 June 2002 Page 33 of 36

TABLE 6-20. F119-PW-100 EMISSIONS FACTOR SUMMARY PARTICULATES MILITARY (Flow by Tracer)

The second secon			•			
		Run N	Run Number			
			,	7	Ave	verage
Flow Rate, dscfm	1823	1823426	182	823426		
		000' 1/sql		lbs/1,000		lbs/1,000
Analyte	lb/hr	lbs fuel	lb/hr	lbs fuel	lb/hr	lbs fuel
Particulate (total)	15.686	0.843	26.157	1.405	20.921	1.124

Test Report Section 6 Revision 2 June 2002 Page 34 of 36

TABLE 6-21 F119-PW-100 PARTICLE SIZE DISTRIBUTION

Particle Size		Engi	Engine Setting	firstina de la compansa de la compa	rode pro r va de deservado de co
Range (um) ª	(%) albi	Approach (%)	Idle (%) Approach (%) Intermediate (%)	Military (%)	tota del control de co
0.5 - < 2.5	70.5	86.3	77.8	96.6	
2,5 - < 5	15.8	5.8	14.7	8.6	of Michael Co. Address and Add
5-<7.5	6.5	2.9	4.3	2.4	THE TAXABLE THE TRACE AND THE TAXABLE THE
7.5 - <= 10	4.3	2.7	3	1.7	m.o., apida yan kana kana akida da ka a a a a a a a a a a a a a a a a
> 10	2.9	2.4	0.7	0.7	Workfordan in New Yorks and the second secon
COMMERCIAL	e de la constante de la consta				
The state of the s	e personal company () to the specific proper to specific specific property and the specific pro		A PROPERTY COLORS AND ADDRESSED AND AN ADDRESSED AND ADDRESSED ADDRESSED AND ADDRESSED AND ADDRESSED AND ADDRESSED ADDRESSED AND ADDRESSED ADDRESSED AND ADDRESSED ADDRESSED AND ADDRESSED		
a - Based on aerodynamic particle diameter	namic partic	e diameter.			
NOTES:	ATTENDED TO THE PERSON OF THE				
Percentages shown based on particle count in each size range	based on pa	nticle count in eacl	n size range.		
Blank analysis showed no filter contamination.	ved no filter c	ontamination.			
The majority of the κ	articles > 2.5	um appear to be <u>o</u>	The majority of the particles > 2.5 um appear to be groups of smaller particles in the $0.03 - 0.05$ um range.	icles in the 0.03 -	0.05 um range.

Test Report Section 6 Revision 2 June 2002 Page 35 of 36

TABLE 6-22 F119-PW-100 JP-8 FUEL METALS ANALYSIS

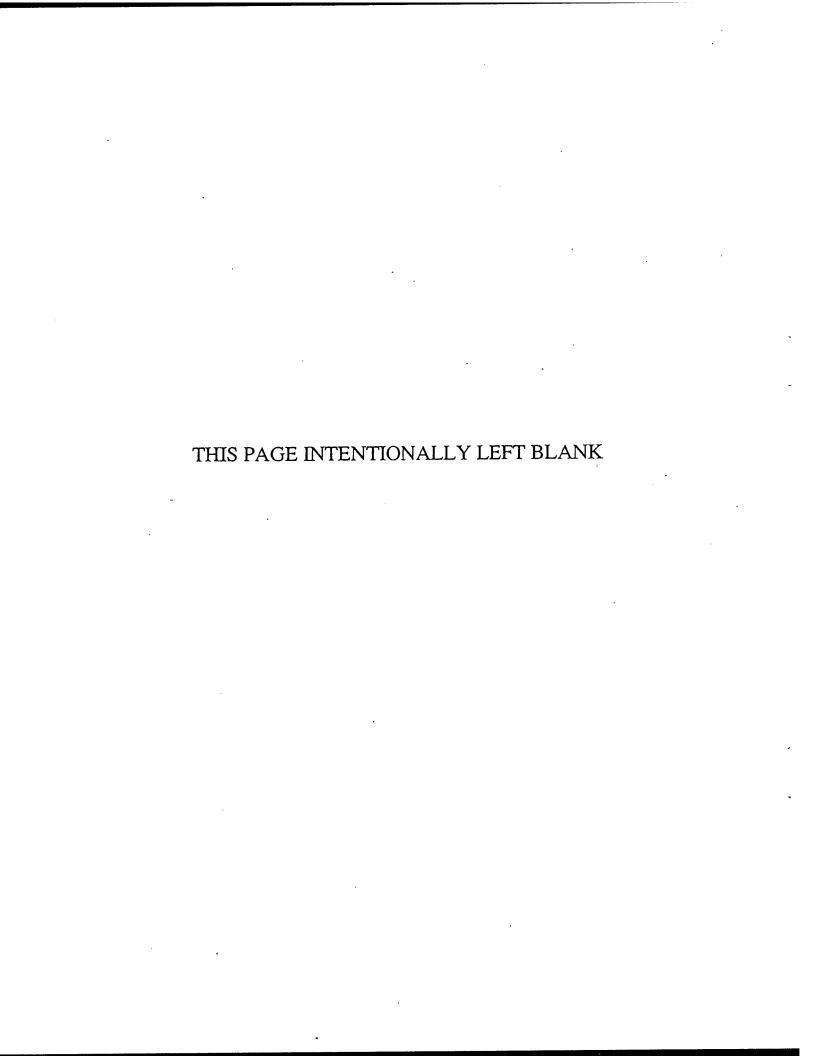
		Sample Number
Compound	JP8-1	JP8-2
	(PPM)	(PPM)
Antimony	QN	QN
Arsenic	۵	2
Barium	Q	Q
Beryllium	Q	₽ N
Cadmium	Q	Q
Chromium	2	S
Cobalt	Q	QN N
Copper	0.054	0.03
Lead	Q	2
Manganese	Q	Q N
Mercury	Q	Q
Nickel	0.038	QN
Selenium	Q	<u>Q</u>
Silver	Q	2
Thallium	Q	0.0075
Zinc	0.058	0.029
Phosphorus	0.35	0.17

Test Report Section 6 Revision 2 June 2002 Page 36 of 36

TABLE 6-23. F119-PW-100 EMISSIONS OPERATIONS SUMMARY

Fuel flow,		Fuel flow,	Average	% Maximum	% Maximum Engine Pressure
· Engine Type	Operation Mode	lbs/hr	Thrust, lbs 1	Thrust 1	Ratio 1
F119-PW-100	ldle	1,377			ter to the control of
ACTIONS AND THE COLUMN AND THE COLUMN ASSESSMENT ASSESS	Approach	2,740	the signature of the state of t)	TOWN WITH THE PROPERTY OF THE
the state of the s	Intermediate	10,110		11. OF 11 POINT BOOK BANK BANK BANK BANK BANK BANK BANK BAN	* RPV (CTTTT GEVEN GERMAND AV (MANAGEMEN AVERTICAL) (MANAGEMEN E
	Military	18,612			Altoco Companio (spiegama) ("Family Companional (Family Companional (Altocated Companiona)
	Afterburner	50,170			
1 Not included as part of this report.	s report.				

APPENDIX A RAW FIELD DATA



Method 0030 - Volatile Organics

Page of

	TENAX Tube Sample Numbers	15007									Zona de la companya d
	TENAX T	Set One	Set Two	Set Three	Set Four	Set Five	Set Six	Set Six Stack Blank			SECOND COND.
)			٠					Set Six			FIRST.
	Vost 4	0.9947	က	Boro			Hg Vac)	Set Five			SAMPLE
	۸	0.9		æ			rs/min @ ii	Set Four Set Five			PROBE
	_		ıgth	<u>ia</u>			Leak Checks (liters/min @ in Hg Vac)	Set Three			DGM OUTLET
	Meter Box ID	Meter Box Y	Probe ID/Length	Probe Material			Leak Ch	Set Two			DGM INLET
•	1	M0030	00	7.0c	87	<i>†</i>	0	Set One	0.005"	7 @0.0	P. DRY GAS !!
			-71-5	52		15	7/1		Initial	Final	REICE
	Run No.	Test Method	Date	Baro. Press (in Hg)	Ambient Temp (°F)	Operator	Sample Time				ROTOMETER FO
	USAF/EQM	3214-008-040	AF	-	LMF119	F22 Engine					IPLE CLOOK!
	Client	W.O.#	Project ID	Mode/Source ID	Samp. Loc.	Source		Comments:			TRAVERSET ("SAN

COMMENTS																			
EXIT TEMP	(၁,)	19	20	20	۲/	72	20	20	77								Max Temp	77	
	(၁၂)	//	3	76	12	/6	8	15	رو								Max Temp Max Temp	9	
VAC		/	1	,			,		\								Max Vac		
		121	150	132	135	137	138	141	2/1								Мах Тетр	241	
TEMP (°C)		WIA															Avg.Tm /	رخ > /د	,
TEMP (°C)		53	34	35	37	38	35	40	1/5				- -				Avg	37.126	
READING	1963.86	967.50	150.651	1973.5	976.5	7.6661	1982.0	1984.56	1986.97						-	/	Total Volume	73.5	
Delta H (in H ₂ O)		1 21	7.7		7 2.1		7.7	7.7	1.2./								Avg Delta H	· r <	4
		h_s	1 /	//	1/2	14	95	35_	35										
time) time)	L401								1127								5	3	
TIME (MIN)	0	5	10	15	20	25	8	35	40								7		
ON ON																		MANAGERIS DESIGNERACIONELLIMIT	

Method 0030 - Volatile Organics

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	TENIAY Tube Committee Numbers	I LIVA I upe sample innimpers	Set One /a o/3	Set Two		Set Tiree	Set Four	Spi Five	13 10 9	Set Six	Stack Diank		Ţ.
	Meter Box iD Vost 4		0.9947	Probe ID/Length	Probe Material				Leak Checks (liters/min @ in Ha Vac)		1		
	2 N	M0030	0	20:21.6	26,06	20	W. t	200	5	Set One	(1 (a) 2	Final •.•@z
	-1	-040 Test Method	Date			9 Ambient Temp (°F)			Sample Time				
Client		3214-008-040	Project ID AF	Mode/Source ID		Samp. Loc.	Source F22 Engine		Commonter	comments.			

	77	19		150	4	15.195	1.225	•	MEDITANTE	
	Max Temp Max Temp	Max Tem	Max Vac	Max Temp	いならずん	Total Volume	Avg Delta		2	WESTERN.
	,									
	0 2	Ó		155	7/7	20/4,720	7.3	76	1231	40
	,,,	4		167	9/2	2011.80	7.3	62		33
	02	1	\	1372	45	2007.85	7.7	77		00 30
	20	1		661	45	2004.55	7.7	43		62 62
	12/2	8/		9%/	pp	2001.25	27	75		07
	200	,	\	137	43	1.888.1	7.2	0,6		6
	2,	1,	\	135	43	2.6811	7.7	28		2 ;
	2	6/	,	143	W/A 43	1992.3	2.7	35		3 5
COMMENTS	(J ₀)		(In Ha)		1 , 3 , 3 , 4 , 5 , 5 , 6 , 6 , 6 , 6 , 6 , 6 , 6 , 6	1984.525	. • •	g kan cua	115/1	0
. V			VAC		TEMP (°C) TEMP (°C	READING (liters)	Delta H (in H ₂ O)	*শ্ব্ধ		
The state of the s	r SECOND	FIRST		PROBE	DGM (DGM PROBE INLET OUTLET TEMP (C)	METER	PRESSURE		I	POINT TIME (min)
									- TOO 12 .	

Run No. Test Method FIELD DATA SHEET USAF/EQM 3214-008-040 Client W.O.#

TENAX Tube Sample Numbers Two Two Three Four		1	
Anics TENAX Set One Set Two Set Three Set Four	Set Six	Set Six Stack Blank	
Orga		Set Six	
Meter Box ID Meter Box ID Meter Box Y Meter Box Y Probe ID/Length Probe Material Material Boro Set Twe Set Four	η Hg Vac)	Set Five	
30 - V	rs/min @ ir	Set Four	
od 00	Leak Checks (liters/min @ in Hg Vac)	Set Two Set Three Set Four Set Five	
Meter Box ID Meter Box Y Probe ID/Length Probe Material	Leak C	Set Two	
3 M0030 4.77.00 29.05 90	40	Set One	0.0 Gr 7
			Initial

1,516,	9/0 /						13 000					COMMENTS																
Set One	Set Title	Set Three	001 11100	Set Four	Set Siv	Stack Blank	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			SECOND.	EXIT TEMP	Q	5	22	1,0		200	57) ;	707	0 4							
						Set Six			- LONG	COND.	EXIT	TEMP	3	10,	, 8,	!	ļ	0,	Į,	1	9			1	1	1		
0.9947		Boro			Ha Vac)	Set Five			CANADI F	TRAIN	VAC	(In Ha)	,	2							1				1			
6.0		ĕ			rs/min @ in	Set Four			"PDODE	TEMP (°C)			٠// د	000	140	10/	10%	10/0/	1000		7				1			
>-	ength	erial			Leak Checks (liters/min @ in Hg Vac)	Set Three			, DGM	OUTLET	TEMP (°C)		1/4	2,0	47	7/2	67				1				-			
Meter Box Y	Probe ID/Length	Probe Material		1	Leak	Set Two			DGM	INLET	TEMP (°C)		0/11	112														
M0030	00.21.6	20.62	20	24	(0	Set One	* 1 00 0.0	0,002"	DRY GAS		READING	2011/02	2020.65	2025.7	2026,6	2029, 5	2032, 4	2035.2	2018.1	2000 77	2							7
			(F)				Initial	Final	ORIFICE	PRESSURE	Jelia ⊓ (iln H₂O)		7.7	7.7	7.5	7.2	7.7	7.7	7.7	2 '/								
DOUBLE SELECTION	Date	Baro. Press (in Hg)	Ambient Temp (°F)	Operator	Sample Time				ROTOMETER "	SETTING			37	4/	40	%	35	35	39	39								
2000	AF		LMF119	F22 Engine					CLOCK	TIME (plant		1249								1328								
		2			•				SAMPLE	IIME (min)		0	5	9	15	20	25	30	35	40								
	Project ID	Mode/Source ID	Samp. Loc.	Source	200000	Collination				NO N																		

Max Vac Max Temp Max Temp

Max Temp

Avg Tm ,

Total Volume

Avg Delta

WEST STATES OF THE PARTY OF THE

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15.3

Method 0030 - Volatile Organics

Page ____ of ___

105

TENAX Tube Sample Numbers Set Six Stack Blank Set Three Set One Set Four Set Two Set Five Set Six Leak Checks (liters/min @ in Hg Vac) Set Three | Set Four | Set Five Vost 4 0.9947 Boro Probe ID/Length Probe Material Meter Box ID Meter Box Y Set Two Set One 7 60 7 6.12-00 M0030 25.06 Baro. Press (in Hg) Ambient Temp (°F) Sample Time Test Method Operator Run No. Date 3214-008-040 USAF/EQM F22 Engine 61::::7 ∢ ΑF Mode/Source ID Comments: Samp. Loc. Project ID Source #.O.W

				ff.							·		_	,			 						
						COMMENTS																	
				,																			
Set Six Stack Blank				SECOND	EXIT TEMP		(S _c)	20	07	202	20	02	61	5/	51								
Sel Oix			1 2	COND		TEMP	(၁)	20	61	5/	61	5,	6/	3/	81								
JC! IVE			1	SAMPLE	VAC	(in Ha)		14	,	,	_	\	,	,									
Set I on I Set LINE			70000	FRUBE TEMP (°C)				144	15-7	152	/5/	////	135	185	1.8.3				-				
2011				OUTLET				47	8/2	6%	87	47	47	47	22								
			. Mod	INLET	TEMP (°C) TEMP (°C)			A. C.															
	0.000 1	2000	DBY CAC	METER	READING	(liters)	2042.685	2045.2	1.8402	2050.85	2054.8	2056.7	205%. 5	2062.5	2004.85								
	Initial	Final	ORIFICE	PRESSURE	Delta H (in H ₂ O)		2	7 2.7	7.7	7.7	7.7	7.7	7.5	7.7	7.7								
			ROTOMETER	SETTING				32	7/2	35	35	35	40	37	38								
			CLOCK	TIME (plant	time)		1614								1659								
							0	5	2	15	50	25	90	35	40								
			TRAVERSE" SAMPLE	POINT	Š.																		

Max Temp Max Vac Max Temp Max Temp

Total Volume

Avg Delta H

22.165

7.7

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0 4

Method 0030 - Volatile Organics

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TENAX Tube Sample Numbers	15005						fools		
TENAX Tu	Set One	Set Two	Set Three	Set Four	Set Five	Set Six	Set Six Stack Blank /foo G		
							Set Six		
Vost 4	0.9947	3	Boro			Hg Vac)	Set Five		
8	6.0		B			s/min @ ir	Set Four		
	1	l dth	Te .	•		Leak Checks (liters/min @ in Hg Vac)	Set Two Set Three Set Four Set Five		
Meter Box ID	Meter Box Y	Probe ID/Length	Probe Material			Leak Ch	Set Two		
2	M0030	7.12.00	\ <u>a</u>	7.5	77	40	Set One	0.00	2000
		5		•)	7		Initial	Final
Run No.	Test Method	Date	Baro. Press (in Hg)	Ambient Temp (°F)	Operator	Sample Time			
USAF/EQM	3214-008-040	AF	A	LMF119	F22 Engine				
Client	#.O.W	Project ID	Mode/Source ID	· Samp. Loc.	Source	1	Comments:		

_		Max Temp	Max Temp Max Temp	Max Vac	Max Temp	Avg Tm X	Avg	Total Volume	Avg Delta /				
								/					
	-												
		51	۲)	/	139	ph		2086.49	2-1	55	1561	40	
		51	()	1	139	ph		7 7802	2.7	35		35	
		19	51	,	138	hh		2081.7	7.7	35		30	
		51	8/	<i>)</i>	189	14		2078.1	7.7.	34		25	
		31	81,	,	139	<i>ኦ</i> /		2020.8	1.2	33		20	
		20	18	,	140	45		2074.4	1.2	32		15	
		20	61	/	142	18		2072.1	7:7	30		5	
		07	61	/	141	45	4n	2008.8	7.7	A+2-26		သ	
		(၁ _၀)	(၁,)				# 19 to	2067.53			1111	0	
COMMENTS			TEMP										
95.		EXIT TEMP	FXIT			TENED (OC)	TEMD 100		Delta H (in H.O)		time)		No.
		SECOND	FIRST	SAMPLE	PROBE	DGM PROBE	DGM	DRY GAS	ORIFICE	ROTOMETER	CLOCK TIME (plant	SAMPLE CLOCY	IRAVERSE POINT

Method 0030 - Volatile Organics

Page of

TENAX Tube Sample Numbers 50/5 Set Six Stack Blank Set Three Set One Set Two Set Five Set Four Set Six Leak Checks (liters/min @ in Hg Vac) Set Two Set Three Set Four Set Five Vost 4 0.9947 Boro Probe ID/Length Probe Material Meter Box ID Meter Box Y Set One 5.72.00 29.00 M0030 3

> Baro. Press (in Hg) Ambient Temp (°F)

Test Method

3214-008-040 USAF/EQM

ΑF ∢

Mode/Source ID

Project ID

W.O.# Client

Samp. Loc.

Source

Date

Run No.

Sample Time

Operator

F22 Engine LMF119

Comments:

				OGI OHE	OGI I MO	set inree	Set Four Set Five	Set Five	Set Six	Stack Blank	•	
			Initial	000								
			Final	C.C @ 2								
TRAVERSE SAME	LE CLOCK	ROTOMETER	ORIFICE		NOU							i
POINT TIME (min) TIME (plant	min) TIME (plant			METER	INI ET	DITI ET	FRUBE	SAMPLE	FIRST	SECOND		*
NO	(time)		Delta H (in H ₂ O)	READING	TEMP (°C) TEMP (°C)	TEMP (°C)	EMP (-C)	VAC	EXIT	COND. EXIT TEMP		\$ Z.
				(liters)				(in Ho)	TEMP		COMMENTS	
0	1805			2051.705					100)	(00)		3.3
2		52	7.7	2054.1	72	5	181	/	A,			\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\
5		34	27	2016.6		15			0;	600		7
15		36	7	20063		1 5	75	1	9	2,		_
20		37		21110		1;	135	1	J.	(4)		Ţ
25		1		1/0/7			137	\	/3	18		
S		0		2/04.7		42	136	(15	6		
00			7.5	2/07.4		42	138	,	14	6/		T
S	T	38	7.7	2/10.5		76	135	,	1,	5,		Т
40	1846	39	7.7	21/2,880		7	187		19/	18/		1
												T
						 -						_
										-		
												Γ-
												T
												Τ-
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	-											—
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												, –
				/		-						
WYERR	5		Avg Delta H	Total Volume	Avg Tm	下	Max Temp	Max Vac	Max Temp Max Temp	Max Temp	,	_
MANAGERS ONERCONELIANTS	EFECONELLIAMES		> '	70,10	10 61.	_	•		- (2	
									(•		

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Method 0030 - Volatile Organics

TENAX Tube Sample Numbers Page of 12017 Set One Vost 4 0.9947 Meter Box ID
Meter Box Y
Probe ID/Length 9.13.00 M0030 Run No. Test Method Date 3214-008-040 USAF/EQM Project ID #.O.W

Set One Set Two Set Three Set One Set Two Set Three O.c. O. 2		
F22 Engine	Boro	Set Three
Sample Time Set One		Set Four
Set One Set		Set Five
Initial O.C.O.3 Final O.C.O.3 CLOCK ROTOMETER ORIFICE DRY GAS	in @ in Hg Vac)	Set Six
Final	Set Four Set Five Set Six	
CLOCK ROTOMETER ORIFICE DRY GAS DGM DGM		
CLOCK ROTOMETER ORIFICE DRY GAS DGM TOGM TIME (plant SETTING PRESSURE METER INLET OUTLET (Inters) 1/1/5 1/1/5 1/2 1/2 1/4 1/2 1/2 1/2 1/4 1/2 1/2		
TIME (plant SETTING PRESSURE METER INLET OUTLET time) 1/2	PROBE SAMPLE FIRST	SECOND
United Dolta H (in H ₂ O) READING TEMP (°C)	TRAIN	
15 11/6-395 1/6-395	VAC	EXIT TEMP
1/15 32 1.2 2/17.85 wh 40 39 1.2 2/12.65 wh 40 39 1.2 2/12/4 43 1.2 2/12/5 44 1.2 2/13/5 44 1.2 2/13/5 5 40 1.2 2/13/5 5 40 1.2 2/13/5 5 5 6 5 6 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7		
42 1.2 2/17.85 wh 40 39 1.2 2/12/4 35 42 1.2 2/12/4 38 40 1.2 2/33.0 38 41 1.2 2/33.0 38 41 1.2 2/33.0 38 41 1.2 2/35.0 39 41 1.2 2/35.0 39 55 40 1.2 2/35.5 35 19 19 19 19 19 19 19 19 19 19 19 19 19 1		(%)
42 1.2 2/2/1 35 42 1.2 2/24,0 35 40 1.2 2/36.05 58 40 1.2 2/36.5 35 4/ 1.2 2/35.7 35 4/ 1.2 2/35.5 35 4/ 1.2 2/35.5 35 5/ 1/5-5 40 1.2 2/35 5/ 1/5-	4 /	20
42 1.2 2/14,9 38 43 1.2 1/27.5 58 40 1.2 1/30.05 58 41 1.2 1/36.05 58 41 1.2 1/36.05 58 41 1.2 1/36.05 58 42 1.2 1/36.05 58 43 1.2 1/36.05 58 44 1.2 1/36.05 58 45 1/37.5 50 46 1/37.5 50 47 1/37.5 50 48 1/38 1/38 1/38 1/38 1/38 1/38 1/38 1/3	\	N (N
43 1.2 21.27.5 58 40 1.2 21.33.7 58 41 1.2 21.33.7 38 41 1.2 21.36.5 59 42 1.3 2.3 2.5 2.5 38 43 1.4 2.5 21.35.5 20 44 1.5 2.5 21.35.5 20 45 1.5 2.5 2.5 2.5 38 46 1.5 2.5 21.35.5 20 47 1.5 2.5 2.5 2.5 38 48 1.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2		200
40 1.2 2/30.05 58 41 1.2 2/33.7 38 41 1.2 2/35.5 38 41 1.2 2/35.5 39 39 102 40 1.2 2/35.5 39 39 39 30 30 30 30 30 30 30 30 30 30		
44 1.2 2133.7 39 41 1.2 2135.5 39 42 1.5 2135.5 39 55 39 79 39		0,
1,5-9 40 1.2 2/36,5°° 39 1,5-9 40 1.2 2/36,5°° 39 39		, ei
1.5-9 40 1.2 2/39.9 37 1.5-9 40 1.2 2/39.9 37	,	7
7/35,5°C	,	
	8/ / 8	/4
Avg Delta H/ Total Volume Avg Tm / Max	Max Temp Max Vac Max Temp	p Max Temp

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Test Method

Date

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Mode/Source ID

Project ID

#.O.W

Samp. Loc.

Source

Run No.

USAF/EQM 3214-008-040 Operator

F22 Engine LMF119

Comments:

Method 0030 - Volatile Organics

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Page

TENAX Tube Sample Numbers 2018 50/2 Stack Blank Set Three Set One Set Two Set Four Set Five Set Six Set Six Leak Checks (liters/min @ in Hg Vac) Set Two | Set Three | Set Four | Set Five Vost 4 0.9947 Boro Probe ID/Length Probe Material Meter Box Y Meter Box ID Set One 8.0 @ r .13.00 M0030 28.87 Initial Final Baro. Press (in Hg) Ambient Temp (°F) Sample Time

2000

	The second secon			COMMENTS																		,						1	1
			MP																				+	+	+			<u>.</u>	-
	7	SECOND	EXIT TE		(၁ _၀)	02	20	20	700	207	01	127	2															Max Tem	(
	1901-1	COND.	EXIT	TEMP	(్రం)	20	61	01	81	61	, a	0/	51															Max Temp Max Temp	
,	CABADIE	TRAIN	VAC	(in Ha)		/		\	-																1			Max Vac	•
	PROBE	TEMP (°C)				651	2/1	136	120	2/	28	138	13.00					+	1							+		Max Temp	- 1
	DGM					0/2	05	13	77	1/2	77/	\ \\$	2/2								1						1	<u>`</u>	
	DGM	INLET	TEMP (°C) TEMP (°C)		A																							1. S. J.	
0.00	DRY GAS	METER	READING	(liters)	2/43.700	2/46. 2	2/49.5	2152.1	2/54.7	2157.5	2/60.00	2/62.5	2165.470														Total Value	oral Volume	2/ 77
inai L	ORIFICE	PRESSURE	Delta H (in H ₂ O)			7.7	2:/	7.2	7.7	7.5	7.7	2.7	7.2														Ava Delta H		
	ROTOMETER"	SETTING			,	55	57	38	32	36	36	36	37																
	CLOCK1	TIME (min) TIME (plant	laum	11.11	2797								752/			1				+							-	5 2	- CELIANIE
	SAMPLE	TIME (min)		0) 4	6	2 ;	2	8	25	30	35	9			†			-									N D	in the same of the
	Щ.	NON																											<u> </u>

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Method 0030 - Volatile Organics

Probe ID/Length Probe Material Meter Box Y Meter Box ID

Vost 4 0.9947 Boro

> 9.14.00 M0030

49.82

Baro. Press (in Hg) Ambient Temp (°F)

Test Method

3214-008-040 USAF/EQM

Date

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Mode/Source ID

Project ID

W.O.# Client

Samp. Loc.

Source

Run No.

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Sample Time

Operator

F22 Engine LMF119

Comments:

Initial Final

TENAX Tube Sample Numbers

Page ___ of _

Set Three Set One Set Two

Set Four

Set Five

Set Six

Set Six Stack Blank Leak Checks (liters/min @ in Hg Vac) Set Two | Set Three | Set Four | Set Five

Service Service Service Service Service Service),00¢	0.0 Ø 2.	DRY GAS DGM F F DGM PROBE SAMPLE FIRST SECOND
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			SENEMBOO	* Transport	のでは、								#36 E/M:/										
	SECOND	COND.	EXIT TEMP		(D ₂ ,	20	61	31	18	61	5/	5/	5/										Aax Temp
	FIRST®	COND.	EXIT	EMP.	(၁)	//	18	2)	> /	9	13	2	2										Max Vac Max Temp Max Temp
			VAC	(110 110)		,	/	\	\		\	,	\										Max Vac
	"PROBE"	1				147	3/1/	136	133	134	781	136	/43										Max Temp
	F DGM	OUTLET	TEMP (°C)		i abico	38	37	36	35	35	35	30	155								-	\	
	J. MOO	INLET	TEMP (°C)																				Avg Tm
100.	"" DRY GAS	METER	READING	10 0 10 0 10 0 0 0 0 0 0 0 0 0 0 0 0 0	41.06.063		2174.5	2177.2	2.08/7	2/83.3	2185.9	2188.7	2191.172									Ψ,	Total Volu
ğ	ORIFICE	PRESSURE	Delta H (in H ₂ O)			1.2	7.7	1.2	7.2	1.7	7.7	7.7	7.7									,	Avg Delta
	ROTOMETER	SELLING	ر در این این در در این در در این در در در این در			100 to 38	70	40	40	4/	47	37	38										
		IIME (plant) (Arms	10.8 AT	25								1111 1116	77/									5
	SAMPLE	(mim) = min)		O) 14	0	9	15	20	25	30	35	40										
	TRAVERSE												-										

73.107

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TENAX Tube Sample Numbers Page ____ of ___ 5003 Set Six Stack Blank Set Three Set Four Method 0030 - Volatile Organics Set One Set Two Set Five Set Six Leak Checks (liters/min @ in Hg Vac) Set Three | Set Four | Set Five Vost 4 0.9947 Boro Probe ID/Length Probe Material Meter Box ID Meter Box Y Set Two Set One 0.003 \$6 35 9.14.00 M0030 18.84 Initial Baro. Press (in Hg) Ambient Temp (°F) Sample Time Test Method Operator Run No. 3214-008-040 **USAF/EQM** F22 Engine LMF119 Σ ĄΕ Mode/Source ID

Final

Comments:

Samp. Loc.

Source

Project ID

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				COMMENTS																					
<u> </u>	on out		EXIT TEMP		₽	97	20	02	20	3	//	02												Max Iemp Max Iemp	,
	┨╏		EXIT	TEMP	3	07	20	07	2	//	7			-									-		
	SAMBLE		VAC	(in Ha)							1	\												Max vac	•
	PROBE	TEMP (°C)					35	135	361	30	185	22											7	dular yelik	,
_		INLET OUTLET	TEMP (°C) TEMP (°C)			3.5	30	200	28	20	200	20											Aug Tan		7, 6.
	DRY GAS		READING	~		2/60/	136:10	2255	22/2	177.6	1210 56.0	• 1											Total Volume		7.00.7
Final	ROTOMETER ORIFICE ""	PRESSURE	Delta H (in H ₂ O)		7.7		1,7	1.	1.7	2 /	17.												Avg Delta A		, ,
	****	SETTING			90	Ş	47	de	42	30	and the same of th														
	CLOCK	TiME (plant	(eum)	L0h1							1442													<u>5</u> 2	B uttavit
	TRAVERSE" SAMPLE CLOCK!	TIME (min)		0	S.	5	15	82	25	8	35	ę	†							+)
	TRAVERS	NON CN			,																				MANAGERS

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Final O. O. U. (1) Syst. no Post-Test Set	yes / no yes / no COMMENT	J. J
K Factor 3,11. 96.85 Initial Mid-Point O.003 Ves. / no yes. / no y	SAMPLE TRAIN VAC (in Hg) SAMPLE TRAIN VAC (in Hg) SAMPLE TRAIN VAC (in Hg)	Max Vac Max Temp
sks (#) (#) (#) (#) (#) (#) (#) (#) (#) (#)	e Response IMPINGER EXIT TEMP (°F) (°F) 66 66 66 66 66 66 66 66 66	
Particul # VC 17 9895 1925 1925 1984 1984 1984 1984 1984 1984 1984 1984	PROBE 244 244 244 244 244 244 244 2	Avg Tst Avg Tor Minghax Minghax Max Tem (41,50 93.08 228/247 250 68. K-factor does not have netter temp or stack temp included. These are input at each point.
nod 5/202	9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	Avg Tst Avg Tot (41,50 93.08 K-factor does not have neter Trys are input at each point.
Meter Box ID Meter Box ID Meter Box Y Meter Box Del H Probe ID / Length Probe Material Priot / Thermocouple ID Priot Coefficient Nozzle ID Avg Nozzle Dia (in) Area of Stack (ff²)	mple Time in Traverse in Trave	1 1 1 1 1
Stack Conditions Stack Conditions Assumed Assumed Actual 3 10.5 149 F) 149 F) 140 F) 140 F)	ST To	Ita W Total Volume SS SS 1.517
TA SHEET Stack C % Moisture Impinger Vot (ml) Silica get (g) CO2, % by Vol O2, % by Vol Temperature (°F) Meter Temp (°F) Static Press (in H ₂ O)	Molent Temp (°F)	Avg Sqrt Delta P Avg Delta N 2.824683 O-[O Owl) Avg Sqrt Del H
C FIELD DA 20054.006.001.2000 AF 1 1 1 1 1 1 1 1 1	29. 06 UAT CLOCK TIME V (plantime) PRE (1044 (1054 (1	Avg Si
	Baro. Press (in Hg) Operator Thaverse Sample Point Thire (min) NO 0 / 6 / 7 / 7 / 7 / 7 / 7 / 7 / 7 / 7 / 7 / 7	W.Silen

F. Her 643

	_	4048	int Final	9	4	io (Yes) no	Post-Test		Pass / Fail	00 / 867		COMMENTS		* Dad Harmon de																	,			
	Page	704	Mid-Point	Ц	\perp	yes / no	Test		Pass / Fail	ves / no		U																			Мах Тетр			
)	a i	K Factor	Initial	20.00	3	yes / 75	Pre-		Pag		SAMPI	TRAIN VAC (in Hg)	•	3	مار	212	۲۰ ۲۰	2,2	1	77	1	100	1	V							Max Vac			
2			ks	in (ft³) @ ½- 11-3	(g Hg)		Š	emp	/- 2°)	Temp Change Response	IMPING	EXIT TEMF (°F)	+		*	. 4	- 1	25	9 (200		95	62	-)						Max Temp \$2			
7. (7.	late	~l	_Leak Checks	Sample Train (ft³)	Leak Check @ (in Hg)	Orsat good	_Temp Check	Meter Box Temp	Pass/Fail (+/- 2°)	Temp Chan	FILTER	BOX TEMP (F)	2/2	20,0	3/2	25.5	200	756	200	255	120	20,0	253	250							Min/Max 257/150			•
	.9	2 WC 19	1680	4 Pom		0.84	7	₩r.0	90	-	PROBE	1	7.00	2%	200	27.3	1,5	15,	226	743	250	202	241	<i>hh</i> ²							Min/Max 23 8 / 233	•		
	5/202 -	0	اتىلا	7184				Ð			DGM	TEMP (°F)	×	38	8.8	87	2	90	20	36	16	26	43	26							7m ✓			
	Tethod		H	ength	ocouple ID	ent	- :	Jia (in) c (ft²)		e Pts	DGM INLET	TEMP (°F)	3X	3	000	89	839	900	16	92	42	76	63	26							Avg Tm 90.33	,		
	EPA N	Meter Box ID	Meter Box Del H	Probe ID / Length Probe Material	Pitot / Thermocouple ID	\$ 500		Avg Nozzle Dia (in) Area of Stack (ft²)	Sample Time	Total Traverse Pts	STACK	TEMP (°F)	ומח	145	745	4	745	146	176	95/	147	94/	三	\ -						7	148.42		-	
	9	tions med Actual						. 7.			DRY GAS METER		497.520	1	507.2	11715	517.0	573.8	528.7	533.6	538.5	543.4	C184S	553.345						\Box	Fotal Volume	Comments:		
į	HEET	Stack Conditions Assumed	()	(m)			1), (5	(J ₀) 42	mp(r)	ORIFICE	Delta H (in H2O)	82	2,83	2.83	2.76	2.76	25'5	2.77	L1.2	2.77	7.7	2.78	2.78							/ S. 0 1417	Avg Sqrt Del H) }
	FIELD DATA SHEET		% Moisture	Silica gel (g)	CO2, % by Vol	O2, % by Vol	1		Ambient Tema (95)		E VELOCITY PRESSURE Delta	P (in H2O)	10:0	0.01	0,9	0.0	0.0	0.02	0.0	0.01	10.0	0.9	0.0	ر ن آ						Ava Cott	6.010%	0.tos45/	100 J	
	L FIELLD	20054.006.001.2000	AF -	LMF119	2	M202	Idle F119-PW-100	12-Sep-00	3 1 2	Y A	CLOCK TIME (plant time)		1150	1155	1200	1205	1210	111	1220	(225	12,00	1235	0/2)	1245							5		Ü	
	DONINE I IC	Ž	e D			<u> </u>			<u></u>	100000	SAMPLE TIME (min)		~	0	٧,	2	25	2	Ž	\$	5	29	×	99								WAGERS TO TRONGLIMIS		
12/03/	Client	W.O.#	Project ID Mode/Source ID	Samp Loc ID	Run No.ID	rest method ID. Date ID	Source/Location	Sample Date	Operator		TRAVERSE POINT	Ö																			WV/=	Same Same		

(AS 1639)

	_ [Final	5003	7	(yes) no	yes / no	Post-Test Set			Pass / Fail	yes / no	COMMENTS		Sun or	اصالي، طيخوس	Hut covered	run 3	Thermound	not responding				-									1		
-	Page of	211,9685	Mid-Point			yes / no	/ no yes / no	est Set			Pass / Fail	yes / no			1				*														Max Temp		
	.	K Factor	Initial	800	SI	(§)	9	Pre-			Pas	yes	SAMPLE TRAIN VAC	(in Hg)	\$.	8	58	3.5	3.5	3.5	3.5	3.5	2.5	3.5	35	35							Max Vac		
5			S,	(fl)	@ (in Hg)		ط ا ا	×	due	dwa	- 2°)	e Response	IMPINGER EXIT TEMP	(ae)	*	*	g)	108	ーー トー	+63	69 +	69 +	+ 69	89+	+ 67	+67							Max Temp		
- F	ale		Leak Checks	Sample Train (ft ³)	Leak Check @ (in Hg)	Pitot good	Orsat good	Temp Check	Meter Box Temp	Reference Temp	Pass/Fail (+/- 2 ⁰)	Temp Change Response	FILTER BOX TEMP	(F)	0 52	662	250	122	862	842	8 hC	9hC	840	848	248	24 g							Min/Max 9-12-1-51		
70.74	- raruculate	1000	369	4	Boro		0.84		43	4	90	-	PROBE	TEMP (*F)	802	622	239	243	243	242	しかめ	245	244	245	244	She				,			Min/Max		
		10	7.0	200	ĕ		0		0.74		9	,	DGM OUTLET	TEMP (°F)	40	16	25	76	93	hb	16	96	96	26	48	66						7	Avg Tm C		
TDA Mathad E/100	como		I	gth	٠	couple ID	ŧ		a (in)	(ff²)		Pts	DGM INLET	IEMP(F)	90	61	76	26	53	ηb	42	96	96	Lb	98	99							S _V S		
EDA M	EFA IN	Meter Box ID	Meter Box Del H	Probe ID ALength	Probe Material	Pitot / Thermocouple ID	Pitot Coefficient	Nozzie ID	Avg Nozzle Dia (in)	Area of Stack (ft²)	Sample Time	Total Traverse Pts	5.1		821	_			146	95/	146	ζ.	五	8 1 /	विष	b h/			-			1	Avg Ts		
		ons od i Actual	Actual						Sec.			46	DRY GAS MET READING (ff		694.52	611.0	703.9	708.8	-	7,8,7	723.6	7.87	733.6	J.38.C	743.6	748,557							Total Volume	Comments:	
FFT	ा वत	Stack Conditions	Tosse C			- I	`	 -	. (In H ₂ O) -0.02	ė	p (°F)	ORIFICE PRESSURE	Delta H (in H2O)	2.83	2.83	2.83	2.83	2.85	2.85	3.8 6	2.86	2.86	2.86	286	286							Avg Delta W		1.68770
ISOKINETIC EIEI D DATA SUFET	חפשושח		% Moisture	Impinger Vol (ml)	Silica gel (g)	CO2, % by Vol	02, % by Vol	1		Static Press (in H ₂ O)		Ambient Temp ("F)	VELOCITY PRESSURE Dalta	P (in H20)	O.O.	000	0.01	900	0.0	0.01	0.01	10.0	10.0	10.0	10.0	0.01							Avg Sqrt Delta P	0.10000	
FIELD	COLL	20054 ODE OUT 2000	AF	-	LMF119	6,	M202	- 1	- 1	12-Sep-00	67.06	NW.	CLOCK TIME (plant time)	7521	1257	1302	1301	1312	1317	(322	(327	1332	1337	2 /5/	1347	1352								- 5	N S
			10					1	음		lg.		SAMPLE TIME (min)	0	5	0)	7	2	2.5	30	34	40	hζh	20	32	90									DESCRIPTION
ISOKIN		W O #	Project ID	Mode/Source ID	Samp. Loc. ID	Run No.ID	lest Method ID	Date ID	Source/Location	Sample Date	Baro. Press (in Hg)	Operator	TRAVERSE POINT	O.																					MANAGERS /

EPA Method 5/202 - Particulate

Client Location/Pl	ant .	USAF/		Source	W.O. # e & Location			6.001.2000		
Location		Lockneed	VIAILIII GA	Source	e & Location		ldle F1	19-PW-100		-
Run No.					Sample Date			Recove	ery Date	9/12/00
Sample I.D.	AF - I - LMF	119 - 1 - M202 ·	12SEP2000		Analyst	Pke		Filter I	Number	641
	4	1 2	1 0 4	<i>m</i> .	Imping					
Contents	1 Di H20	2 Di H20	3 P) 4	5	6	7	Imp.Total	8	Total
						<u> </u>		Lat. 18 To 18	Silica Gel	
Final	84	113	101					ļ	314.7	
Initial	100	100	(00)						300	
Gain	-16	13	1					1-2	14.7	12.7
Impinger Cole	or _	Clear	7	4 DI Rim	Labeled?	yes				**************************************
Silica Gel Co	ndition _	Clear 1/2 spect	····	3 benau	Sealed?	yes				_
						- V				
Run No.					Sample Date			Recove	ery Date	9/12/00
Sample I.D.	AF - I - LMF	119 - 2 - M202 -	12SEP2000		Analyst	PAR		Filter N	iumber	640
				<u> </u>	Imping	er				
	1	2	3 (2)	4	5	6	7	Imp.Total	8	Total
Contents	Di H20	Di H20	Empty-						Silica Gel	L2444-84
Final	94	103	101						313	
Initial	100	100	100						300	
Gain	&	3	1		-			-2	13	11.0
Impinger Colo	or	Clear	53	MOIRES	tabeled?	ies				
Silica Gel Con	ndition	Magnet 14 court		DemRin	رح Sealed?	ues				- .
						=				
Run No.	3				Sample Date	12-Sep-00		Recove	ry Date	9/12/0
Sample I.D.	AF - I - LMF1	19 - 3 - M202 -	12SEP2000		Analyst	N4		Filter N	lumber	639
					Impinge	*/	·····			
	1	2	3	4	5	6	7	Imp.Total	8	Total
Contents	Di H20	Di H20	Empty DI W						Silica Gel	
Final	<u> </u>	100	102						316	
Initial	100	100	100						300	
Gain	-6		192					-4	طا	12.0
Impinger Color		CLERK	<u> 1</u> 4		Labeled?	4				
Silica Gel Con	dition				Sealed?	14				
Check COC for S	Sample IDs of	Media Blanks				/!\		(7)	733 510	

Black S. Her# 642

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]	Final		yes) no	yes / no	Post-Test Set		- Pass / Fail	yes / no												-											\{ \{ \} \}	-
	Page 1 of	1.011	ê	INIG-POINT		no yes / no	/ no yes / no	e-Test Set		Pass / Fail	yes / no											0		ک								╂╌╂	c Max Temp		
Š	1. C	K Factor		Soo O	1	(ves) no	with yes / no	Ĭ				IMPINGER SAMPLE	-		4,4	700		5.0	_	_	7 55		5.5	8 5.5									emp Max Vac		
3.4	ate		700	Sample Train (ft ³)	Leak Check @ (in Hg)	Pitot good	Orsat good	lemp Check Meter Rox Temp	Reference Temp	Pass/Fail (+/- 2 ⁰)	Temp Change Response	FILTER IMPII		37 962	5/ 4/2		-	746 64	49 8 PC	-	346 67	, (+	tus/248 (S)		
	EPA Method 5/202 - Particulate	2 W.17	74845	4	Boro		0.84	76th U					F) TEMP (°F)	1235	T	1,52	236	239	239	336	750	236	737	235	235							1 1	133/231 C		
	d 5/202		O	1810								LET DGM	(P) TEMP (P)	70/	-		201		7 105	501	70/	701	۲۵/	109	ho,		-						Avg Tm (04.25		
	Metho	OX ID	Meter Box Y	Probe ID / Length	faterial	Pitot / Thermocouple ID	Pitot Coefficient	Avg Nozzle Dia (in)	Area of Stack (ft²)	Time	I otal Traverse Pts	NI WOO XC	(F) TEMP (701 /02	173	50/	105				105	7,7	-	70) O	70,					+	1				
	EPA	_	*	Probe II	Probe Material	Pitot / Ti	Priot Coef	Avg No.	Area of	Sample Time	l otal Tra	ETER STACK	3.2.	740	15/	151	QS)	1		87	150	-	05/ 18	150	123				-		-	\forall	30.05)		
		_	med Actual	· 4 · 24					05	95		DRY GAS M READING	6 STL-	1,0	762.2	169.8	.٦٦٤.	782.3	0.686	195.7	802.4	808.	lý!	821.9	878							ŀ	7.6.67	Comments	
	EET	Stack Conditions	Assumed 3	**************************************		i	(F)	! :	1	(₀ E)	(1)4	ORIFICE PRESSURE	Delta H (in H2O)	5.17	5,14	6.09	JE 50 5.16	4.59	5.16	5,16	5:16	4.59	5.16	5.10	91.5								S. 14167	2.26621	
	ISOKINETIC FIELD DATA SHEET		Moisture	Impinger Vol (mt)	Silica gel (g)	CO2, % by Vol	Temperature (°F)	1 1	Static Press (in H ₂ O)	Ambient Temp (9E)		VELOCITY PRESSURE Delta	P (in H2O).	0,09	0.09	0/0	0.09	\$0.0	0.09	0.04	0.00	0.08	0.01	000	8.0							O city Dalta	Order Cellar	L	ı
	FIELD	USAF/EQM	AF AF	4	LMF119	Mono	12SEP2000	Approch F119-PW-100	12-Sep-00	11.00	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	CLOCK TIME (plant time)	1,607	7/9)	ilori	16 22	1,527	16 32	1221	2591	_	7652	1657	101	L021								-	œ.	
''رب	INETIC			G B		٩		1 1	- F	/6: m		SAMPLE TIME (min	0	N	0	1/2	3,	3	20	35	2	F	9	is	3			·					THANK!	TSHOOMING TO	
	ISOK	Client VV O #	Project ID	Mode/Source ID	Samp. Loc. ID	Test Method ID	Date ID	Source/Location	Sample Date Raro Press (in Ho)	Operator		TRAVERSE POINT	9																				W/E	Separate Sep	

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•	Page 1 of 1	0.00% Nid-Point Final		yes / no yes / no yes / no	Test Set Post-Test		1		yes / no yes / no	SAMPLE TRAIN VAC COMMENTS			7 6	0,7	7.0	7.7	&, ≥	2.5	\$		• 00	×							Max Vac Max Temp	
) =		Leak Checks Sample Train (ft²)	Leak Check @ (in Hg)	Orsat good	Temp Check	Meter Box Temp	Reference Temp	Pass/Fall (+/- 2)	lemp Change Kesponse	FILTER BOX TEMP		\perp	75 52	1	-	1253 S7	548 S4	257 60	754	1253 62	252	119 252							Min/Max Max Temp	-
.,	Meter Box Y 0. 9894	674 1680	Boro	0.84		9640	4	09		0 <u>1</u>		7	75 76		96 352	82 16	48 253	19	152	657 601	026 (0)	152 001						,	Avg Tm Min/Max 97.25	1
DDA Martha			Probe Material Pitot / Thermocounte ID	Pitot Coefficient	Nozzie ID	Avg Nozzle Dia (in)	Area of Stack (ft*)	Sample Time	Total Havelse Pts	FR STACK DGM INLET		25 25	+		1/50 16	ry 02/	1,50 4,8	150 44	149 99	1:19 100	001 1961	31 (2)			•		 - -		Avg Ts 145.33	
,	Stack Conditions Assumed Actual		> 0	20.5	150	9	-0.05		The second section of the second seco	ORIFICE DRY GAS METER PRESSURE READING (#1) Delta H (in H2O)	. 2 23.	100.07	_1_		Н		\dashv	و	4.46 619.3			4.46 632, 188						L	Avg Delia H Total Volume (1,5133) + 3.600	
ISOKINETIC FIETD DATA SHEET	Stack	Impinger Vol (ml)	Silica gel (g) CO2, % by Vol	O2, % by Vol	1	.100 Meter Temp (°F)	1	Ambient Temp (°F)	7. KV.	VELOCITY PRESSURE Delta P (in H2O)		280				0.0	-	-	+		09							i	Avg Sqrt Delta P Avg	
ETIC FIFT D	USAF/EQM 20054.006.001.2000		LIMF119	M202	1	Approch F119-PW-100	1		A reservoir of the state of the	SAMPLE CLOCK TIME (min) (plant time)	21/1 0	 		Ü	25 1737	\dashv		+	+	+		28								
NIXOXI	Client W.O.# Project ID	Mode/Source ID	Run No.ID	Test Method ID	Date ID	Source/Location Sample Date	Baro, Press (in Hg)	Operator		TRAVERSE POINT NO.	元·阿里斯·斯特·斯特·斯特·斯特·斯特·斯特·斯特·斯特·斯特·斯特·斯特·斯特·斯特																		X/2///	

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Final O.OCE O.OCE O.OSE O.	NE NEWWOOD		
K Factor (6), 93-// Initial Mid-Point O-O-D Set 7 no yes / no			Мах Тетр
K Factor (Initial O.o.l.) Ves / no Pre-T Pass	SAMPLE TRAIN VAC (in Hg)	10000000 00000000	Max Vac \$ \$
ate Leak Checks Sample Train (ft³) Leak Check @ (in Hg) Pilot good Orsat good Temp Check Meter Box Temp Reference Temp Pass/Fail (+/- 2°) Temp Change Response		13000000 13000000	Max Temp
late Leak Checks Sample Train (ft³) Leak Check @ (in Hg) Pitot good Orsat good Temp Check Meter Box Temp Reference Temp Reference Temp Pass/Fail (+/- 2°) Temp Change Respon	<u> </u>	277.8	WinMax XeMniM
EPA Method 5/202 - Particulate Weter Box ID Weter Box Y Weter Box Y Weter Box OF Weter OF Weter Box OF Weter OF We		2272 224	Mig/Max 243 /256
5/202 -	CO)	0 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	Avg Ta
Fethod (170 (75)	101 101 101 101 101	
EPA Methor Meter Box ID Meter Box ID Meter Box Y Meter Box Del H Probe ID / Length Probe Material Proto Material Proto Coefficient Nozzle ID Avg Nozzle Dia (in) Area of Stack (ft²) Sample Time	217ACK 148 148 148 148	5 9 7 9 7 9 7 9 7 9 7 9 7 9 7 9 7 9 7 9	Avg TS
Actual	BY GAS METER READING (K*) 875. 3 875. 3 841. 9 841. 9 841. 9 858. 4 858. 4	200 6 6 6 7 7 6 7 7 6 6 6 7 7 8 8 8 9 7 6 7 7 8 8 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	Total Volume 7 8, 327
Stack Conditions Assumed 3 m) 2 co.5 20.5 FF HBO COOS	шк	12.22.22.22 12.22.22.22 12.22.22.23.23.23.23.23.23.23.23.23.23.23	Avg Delta H 5,000 £3 Avg Sqrt Del H Co
ATA SHI "Moisture Impinger Vol (r Silica gel (g) CO2, % by Vol Temperature (f) Meter Temp (* Static Press (ir	elta ella	00000000000000000000000000000000000000	Avg Sqrt Delta P 0.29571
	CLOCK TIME (Pant time) 18 19 18 19 18 24 18 24 18 34	1853 1808 1909 1919	
(Hg)	SAMPLE ON OF SIZE	ENGRESS	Sa Charles
Client W O.# Project ID Mode/Source ID Samp. Loc. ID Run No.ID Test Method ID Date ID Source/Location Sample Date Baro. Press (in Hg) Operator	WAVELSE POINT NO		MANAGE RS

EPA Method 5/202 - Particulate

Client		USAF/I	EQM		W.O. #		20054	006.001.2000		
Location/Pl	ant _	Lockheed N		Source	e & Location)	Approch	F119-PW-100		-
					· · · · · · · · · · · · · · · · · · ·				*	-
Run No.				•	Sample Date	12-Sep-00		Recove	ery Date	9/12/00
Sample I.D.	AF - A - LMF	119 - 1 - M202	- 12SEP2000	<u>)</u>	Analyst	me		Filter N	Number	638
					Imping					
	1	. 2	3 (en	2) 4	5	6	7	imp.Total	8	Total
Contents	Di H20	Di H20	Empty-	PCHIC					Silica Gel	380
Final	93+1-3	113	23-	113					318.7	
Initial	100	100	100						300	·
Gain	-7	13	13					19	18.7	37.7
Impinger Col	or <u></u>	lear	Ġ	Edi Riza	_ Labeled?	Yes				1.5.1.
Silica Gel Co	ndition —	1/4 spent	_ 3	O Den Ru	, Spalad?	Uns				-
000		79 - [(Sealed?	- Jes				-
Run No.	_2_				Sample Date	12-Sep-00		Recove	ery Date	9/12/00
Sample I.D.	AF - A - LMF	119 - 2 - M202 -	- 12SEP2000	•	Analyst	PAC		Filter N	lumber	637
				\sim	Imping	er				
	1	2	3 (0,		5	6	7	Imp.Total	8	Total
Contents	Di H20	Di H20	Empty	ענ איז. די	 				Silica Gel	
Final	93	104	111				***		321.4	
Initial	100	100	100						300	
Gain	-7	4	11	-			•	8	21.4	29.4
Impinger Cold	or <u>c</u>	lean	50,	al di Rinsa	Labeled?	Yer				
Silica Gel Cor	ndition	3/4 spant		nl Dom Re		4.				•
					Ocaleu :					
Run No.					Sample Date	12-Sep-00		Recove	ry Date	1/12
Sample I.D.	AF - A - LMF1	19 - 3 - M202 -	12SEP2000		Analyst	PAC		Filter N	umber	636
					Impinge	er				
	1	2	3	4	5	6	7	Imp.Total	8	Total
Contents	Di H20	Di H20	表fights							
Final	95	1/2	104	7					320.1	
Initial	100	100	(00						300	
Gain	-5	12	4					11	20./	31.1
Impinger Colo	r <u>c</u>	lear 4 ascel			Labeled?	V		//		
Silica Gel Con	dition <u>3</u> /	4 useel			Sealed?					

Final d. Cc 3 B B Set no Yes I	COMMENTS	
actor (2792) Itial Mid-Point OS N no yes / no / no yes / no Pre-Test Set		Мах Тетр
K Factor Initial CONSTRUCTION WEST OF THE PRE-TE	SAMPLE TRAIN VAC (In Hg) 6.5 7.0 7.0 7.0 7.0 7.0	Мах Vас 7.0
. (Hg)	STANDER INTERPRETATION OF STANDER INTERPRETA	Мах Тетр
Leak Checks Sample Train (ft³) Leak Check @ (in Hg) Pitot good Orsat good Temp Check Meter Box Temp Reference Temp Pass/Fail (+/- 2°) Temp Channa Reservent	1246 246 246 246 246 246 246 246 246 246	Wiphwax APL
Particu 78895 7925 7925 8000 8000 8000 4 8000 1 900	25.5 25.5 25.5 25.5 25.5 25.5 25.5 25.5	MinMax 336 AST
0.782 0.989 0.989 0.984 0.884	0000 PGW 000	L S
ethod 5 H H Supple ID R ((in) fr²) Pis	6 C 2 C C C C C C C C C C C C C C C C C	420° Tm V
Here Box ID Meter Box ID Meter Box Y Meter Box Del H Probe ID / Length Probe Material Proto Coefficient Nozzle ID Avg Nozzle Dia (in) Avg Nozzle Dia (in) Avg of Stack (it²) Sample Time Refer R	192 (93 93 94 94 94 94 94 94	Avg Ts 193.08
med Actual	DRY GAS METER READING (R.) 907, 411 907, 411 920.9 941.9 941.9 942.8 962.8 963.1 976.4 983.1	Total Volume 80.669
Assurt Assurt 20. 20. 20. 20. 20. 20. 20. 20. 20. 20.	S. 78 S. 78 S. 78 S. 78 S. 78 S. 65 S. 78 S. 78	Avg Delta Y
SOKINETIC FIELD DATA SHEET USAF/EQM	VELOCITY PRESSURE Delta P (In H20) O. 44 O. 41 O. 44 O. 44 O. 44 O. 44 O. 44 O. 42 O. 43 O. 44 O. 42 O. 43 O. 44 O. 42 O. 43 O. 44 O. 42 O. 42 O. 43	Avg Sqn Øelta,P
C FIELD L USAFEOM 20054.006.001.2000 AF N LMF119 1 M202 12xeP2000 mediate F119-PW- 13-Sep-00	CLOCK TIME (Plant time) 110 115 125 125 126	
NETIC 280 00 00 00 00 00 00 00 00 00 00 00 00 0	System 6 No	TO STATE OF THE PARTY OF THE PA
Client W.O.# Project 'D Mode/Source ID Samp. Loc. ID Run No.ID Test Method ID Date ID Source/Location Sample Date Baro. Press (in Hg) Operator	TAN VERSE POOR NO NO	WAGES STATEMENT OF

8 8 2	Pass / Fail	yes / no COMMENTS				0 VAI 発出了	7005	du du
K Factor (2.8 Initial Mid-	Pass / Fail	yes / no SAMPLE TRAIN VAC (in Hg)	0=	7	27 27 27 27 27 27 27 27 27 27 27 27 27 2	12.5		Max Vac Max Temp
ate Leak Checks Sample Train (it²) Leak Check @ (in Hg) Pitot good Orsat good	Temp Temp (+/- 2 ^o)	Temp Change Response FILTER IMPING BOX TEMP EXIT TEMP (F) (°F)	99	Z KY C	77.50	1 h		Max Temp
Culate Leak Checks Sample Train (ft³) Leak Check @ (in Leak Check @ (in Pitot good Orsat good Temp Check	Meter Box Temp Reference Temp Pass/Fall (+/- 2 ^o)		2	25.37 25.37	2027			3 2 Mipmax
2 - Parti	0.35 0	DGM PROBE OUTLET TEMP ("F)		40 RTS		7 247		Mynnex PA-53
:hod 5/20		W INLET		200000000000000000000000000000000000000		42 42		4vg Tm (
EPA Method 5/202 - Particulate Meter Box ID W.C. 19 Meter Box Y Meter Box ID Leak Priot (Thermocouple ID) Priot (Orsat Nozzle ID) Temi	Avg Nozzle Dia (in) Area of Stack (ft²) Sample Time	STACK DGI	764 764	+++				196° F
Actual		DRY GAS METER READING (II ³)	P. 94.9	659.7 659.0 600.0	680 5 694.7 100	708-1		Total Volume 8 / 76 / Comments:
Stack Conditions Assumed Assumed Loss (F) Loso	ڻ ا,ا	ORIFICE PRESSURE Delta H (in H20)	5.39	5.5	5.64 5.64 5.64	ار ا ا ا ا		Avg Deltä H SSABS Avg Sqrt Del H
DATA SHE] st no "Moisture "Impinger Vol (ml) Silica gel (g) CO2. % by Vol O2. % by Vol Temperature (°F)	13-Sep-00 Static Press (in H ₂ O) 2 8 9 7 Ambient Temp (°F)	elta	0.43	54.0 0.43	9.44 9.43	0.43 0.48		Avg Sqrt Defta P D,65657 8
C FIELD I USAF/EQM 20054.006.001.2000 AF N LMF119 2 M202 12SEP2000	13-Sep-00 28.97	이 원 보	1223	1233 1233 1233	12.48	30;1;13 E1;13		æ
<u>교</u>	Sample Date Baro. Press (in Hg)	TRAVERSE SAMPLE POINT TIME (min) NO.	N 5 %	25 25 25 25 25 25 25 25 25 25 25 25 25 2	24,6	H 03		

EPA Method 5/202 - Particulate

Client		USAF	F/EQM		W.O. #		20054.00	6.001.2000		
Location/P	lant	Lockheed	Martin GA	Sour	rce & Location	1	Intermediate		100	_
_								11101 11		
Run No.					Sample Date	e 13-Sep-0	00	Recov	ery Date	a 112 las
Sample I.D.	AF - N - LM	1F119 - 1 - M20	2 - 12SEP2000	1	Analyst	1			-	9/13/4
						_/4		Filter	Number	632
ł	1	2	3	4	Imping 5	je # 6		T		
Contents	Di H20	Di H20	Empty		 	 	7	Imp.Total		Total
Final	99	118	100			†				W W.
Initial	100	100	100			 		<u> </u>	321.9	
Gain	-1	18	0		·			 	300	ļ
				<u> </u>		 			21.9	38.9
Impinger Col	-	CLUPA			Labeled?	M_				,
Silica Gel Co	ndition	3ky spout			Sealed?	/ \/\				-
						#				
Run No.	_2_				Sample Date	: 13-Sep-0	0	Recove	ery Date 4	2.12.00
Sample I.D.	AF - N - LMF	F119 - 2 - M202	- 12SEP2000		Analyst	phA	-			
			DiHeo		Imping			riilei l	Number [*]	631
	1	2	3	4	5	6	7	Imp.Total	8	T-4-1
Contents	Di H20	Di H20	-Empty					The state of the s	Silica Gel	Total
Final	94	116	108						324.2	A. W. S.
Initial	100	100	100						300	
Gain	-6	16	8		-			18	242	42.2-
Impinger Colo	or <u>c</u>	clear			Labeled?	<u> </u>				10.5
Silica Gel Con	dition 3/	4 med			Sealed?	/-				
					Ocaleu:	$=$ $\frac{1}{2}$				
Run No.	3				Sample Date	13-Sep-00	1	Danner		
Sample I.D.	AF - N - LMF	119 - 3 - M202	- 12SEP2000		Analyst	10-сер-ос	'	Recove	•	
ĺ					Impinge	<u> </u>		Filter N	lumber (630
	1	2	3	4	5	6	7	Imp.Total		
Contents	Di H20	Di H20	Empty			<u>~</u>		imp. rotar	8 Silica Gel	Total
Final								- AND ARTS - 37840	Jinua Gel	
Initial	100	100								
Gain									300	
Impinger Color					Labeled?		L			
Silica Gel Cond					-					
					Sealed?					

Check COC for Sample IDs of Media Blanks

WYSTEDIA.

of Lind Final Cocy Cocy No yes / no yes / no Post-Test Set	COMMENTS STOR 1110 1037.991	35
K Factor 6.6127 Initial Mid-Point O.005 /5 /F Pass / Fail	SAMPLE TRAIN VAC (in Hg) [1.5] [1.5] [1.5] [1.0]	13.0 Max Vac. Max Temp
3		Max Temp
	<u> </u>	243 244 247 247 240 24 247
	DGM OUTLET TEMP (°F) 997 997 997 997 997 997 997 997 997 99	
EPA Method 5/202 Meter Box ID Meter Box Y Meter Box Per Probe ID / Length Probe Material Proto Material Proto Coefficient Nozzle ID Avg Nozzle Dia (in) Avg Nozzle Dia (in) Area of Stack (it²) Sample Time	239 93 246 97 246 97 247 97 247 97 247 97 247 97 247 97 247 97 247 97 240 91 240 96 244 96	4 4 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
Here Box ID Actual Meter Box De Meter Box De Probe ID / Le Probe Materia Pritot / Thermo Pritot Coefficie Nozzle ID Avg Nozzle D Area of Stack Sample Time Total Travers	(m) 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	00me Avg 15
Conditions Assumed Ass	ORIFICE DRY GAS ME PRESSURE READING (190.557 190.557 190.557 190.557 190.557 190.557 190.557 190.657 1	
SOKINETIC FIELD DATA SHEET	4 2 2	Avg S
IC FIELD DA USAFIECIM 20054.006.001.2000 AF M LMF119 12SEP2000 Military F119-PW-100 14 12-SEP-00 78.94	CLOCK TIME (plant time) 10 34 10 34 10 34 10 44 1054 1104 1106 1115 1115	0h11
ISOKINETIC Client W.O.# Project ID Mode/Source ID Samp. Loc. ID Run No.ID Test Method ID Date ID Source/Location Milite Sample Date Baro. Press (in Hg)	1. Time (min) 0 0 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	SWILL SHOOKS
Client W O.# Project ID Mode/Source ID Samp. Loc. ID Run No.ID Test Method ID Date ID Source/Location Sample Date Baro. Press (in F	TRAVER POINT NO	MANAGE RS

INETI	C FIELD D USAF/EQM 20054.006.001.2000 AF M LMF119	DATA SHE] St Doo % Moisture Impinger Vol (ml) Silica gel (g)	ΰα	Actual	EPA Method 5/202 - Particulate Meter Box ID Meter Box Y Meter Box Del H 1, 7 G80 Leak Probe ID / Length Probe Material Boro Leak	thod 5/2	202 - Pari	articuls	ate Leak Checks Sample Train (It³) Leak Check @ (in Hg)	Нд)		Page Col	Final
Test Method ID	M202	CO2, % by Vol O2, % by Vol Temperature (%)			Pitot / Thermocouple ID Pitot Coefficient	age D	0.84		Pitot good Orsat good		yes / no yes	yes / no	yes / no
Location	Military F119-PW-100	1 1	F) 9896		Avg Nozzle Dia (in)		0.300		Meter Box Temp	, <u>e</u> :	51-51	1961	1031-1631 361
ess (in Hg)	hb 82		1		Sample Time		90		Pass/Fail (+/- 2°)	: :::	Pass / Fail	Fail	Pass / Fail
Operator	4	Ambient Temp (*F)	('F)		Ë		-		Temp Change Response	Response	yes / no	uo Ou	yes / no
TRAVERSE SAMPLE POINT TIME (min) NO.	E CLOCK TIME In) (plant time) PR	PRE	ORIFICE DE PRESSURE E Delta H (in H2O)	DRY GAS METER READING (R')	R STACK DOTTEMP (°F.)	DGM INLET DGN TEMP (F) TEMP (ET (F)	PROBE TEMP ('F)	FILTER BOX TEMP (F)	IMPING EXIT TEMP (°F)	SAMPLE TRAIN VAC (in Hg)		COMMENTS
5	0) h/	0.82		722.4	852	7	hb	250	252	79	∞		W. Target
0	75	08,0	0	0.52	260	\dashv	_	952	357	46	الما		
2 5	300	7.00	5.32	1,35.57	200	2 (919	2.46	244	25	8,5		
2 1/2	1435	0.78	+	149.1	25.8	5 %	+	242	255		0 12		
30	7435	71.0	-	755.8	827	26	48	2,20	23	62	0.6		
\$! ·	1440	ø. 8v	5,20	762.5	259	86		252	255	65	9.0		
3	1421	86.0		8.8dC	246	8 8	Н	249	344	ري	9.5		
¥	1456	78.0	5.32	7-5-7	358	6.1	_	245	249	59	9.5		
ھ	1201	78.0	5.32	782.4	760	98		250	249	63	9.5		-
<u>ئ</u> ا	lsoe	0.87	5.32	789.1	259	28	98	848	152	65	9, ح		
ક	1511	0.80	5.20	715.872	760	८४	44	للمر	252	89	5.5		
						1						-	
					+								
						-	 						
			,			-							
			_	_	2				_		+		
TW/ a K a k	Σ	0,899034		See Y	257.83	97.17		0 / Che	NO N	Max Temp	Max Sec	Max Temp	_
79763	ۓ ڇ		Avg Sqrt Del H Cor	Comments:				6	Š)	-		-w//
		_						>					

EPA Method 5/202 - Particulate

Client		USAF/	EQM		W.O. #		20054.00	06.001.2000		
Location/Pla	ant	Lockheed I	Martin GA	Source	& Location			119-PW-100		-
Run No.	1				Sample Date	13-Sep-00	•		ery Date	9/14/0
Sample I.D.	AF - M - LMF	119 - 1 - M202			Analyst			Filter N	lumber	<u>634</u>
	1] 2	3	4	Imping 5	er 6		I lana Tak i		
Contents	Di H20	Di H20	*Empty=	7		-	7	Imp.Total	8 Silica Gel	Total
Final	108	110	102					3 Z ပ	320.5	Edward Control
Initial	100	100	100					300	300	
Gain	8	10	2					20	20.5	
Impinger Col	or				Labeled?					
Silica Gel Co	ndition				Sealed?					
Run No.					Sample Date	13-Sep-00		Recove	ery Date	9/14/00
Sample I.D.	AF - M - LMF	119 - 2 - M202	- 12SEP2000		Analyst	PAC		Filter N	lumber	633
					Imping	er			·	
Contents	1 Di H20	2	3 20.46	4	5	6	7	Imp.Total	8	Total
	99	Di H20	_Empty						Silica Gel	
Final Initial			100						323	<u> </u>
	100 -7 l	100	4					10	300	
Gain			L = I		L			10	23	
Impinger Cold	-	Car			Labeled?	yes			·	•
Silica Gel Cor	ndition	1/2 sput			Sealed?	yes				
	_									
Run No.	3_			(Sample Date	13-Sep-00		Recove	ry Date	
Sample I.D.	AF - M - LMF119 - 3 - M202 - 12SEP2000 Analyst Filter Number									
	1 1	2	3		Impinge			1.		
Contents	Di H20	Di H20	Empty	4	5	6	7	Imp.Total	8 Silica Gel	Total
Final									Sinca Gei	
Initial	100	100							300	
Gain									300	
Impinger Colo			_		Labeled?			<u>-</u>	•	
Silica Gel Con	dition				Sealed?					

Check COC for Sample IDs of Media Blanks

CXESTEDY.

CHEET	
ATAG	
CIC FIFT D	
ISOKIN	

*EPA Method 0011 - Formaldehyde

GER SAMPLE COMMENTS
IMPINGER EXIT TEMP T (°F)
F) TEMP (°F) (F)
DGM INLET OUTET) TEMP ("F) TEMP ("F)
AS METER STACK DING (R.) TEMP (°F) 319,576.3
ORIFICE DRY GAS MEI PRESSURE READING (# eita H (in HZO) WESSURE CREATING A STATEMENT OF STATEMEN
VELOCITY PRESSURE Delta P P (in H20) Del
E (min) (plant tyme)
O/ O NO



EPA Method 0011 from EPA SW-846 Max Vac

Max Temp

Max Temp

Total Volume

Avg Sqrt Delta P

Comments:

Avg Delta H
-0.12550
Avg Sqrt Del H
-0.43326

*EPA Method 0011 - Formaldehyde

Client		USAF	EQM	_	W.O. #		6.001.2000			
Location/Pla	ant	Lockheed I	Martin GA	Source	e & Location		ldle F1	19-PW-100		- -
Run No.	_1_				Sample Date	12-Sep-00		Recove	ery Date	
Sample I.D.	AF - I - LMF1	119 - 1 - M0011	- 12SEP2000	<u> </u>	Analyst	Ale		Filter I	Number	
		Т .	T		lmping					
Contents	1 DNPH	2 DNPH	3 DNPH	4	5	6	7	Imp.Total		Total
	1			-	 					19304 193
Final	142	5 0	122		ļ			<u> </u>	319.2	
Initial	100	100	100						300	./
Gain	42	-50	22					14	19.7	33.2
Impinger Cole	or <u>r</u>	DARK YELON	<u>.</u>		Labeled?	1				
Silica Gel Co	ndition <u></u>	2 5000			Sealed?					
Run No.					Sample Date	12-Sep-00	-	Recove	ery Date	
Sample I.D.	AF - I - LMF1	19 - 2 - M0011	- 12SEP2000	•	Analyst		•	Filter N	lumber	
			1		Imping	7				
Contents	1 DNPH	2 DNPH	3 DNPH	4	5	6	7	Imp.Total	8	Total
Final			- Citi II		 				Silica Gel	line 121
Initial	100	100	100		<u> </u>				300	
Gain			-							
Impinger Cold	or				Labeled?	<u> </u>				L
Silica Gel Cor	ndition				Sealed?					•
Dun No										
Run No.	3_			;	Sample Date	12-Sep-00			ry Date	
Sample I.D.	AF - I - LMF1		- 12SEP2000		Analyst			Filter N	lumber	
	1	2	3	·4	Impinge 5	er 6	7	loss Tatal		
Contents	DNPH	DNPH	DNPH	- T		0		Imp.Total	8 Silica Gel	Total
Final								erweet to up 1888		magistri o e ri ilia dibili
Initial	100	100	100	W					300	
Gain										
Impinger Colo	r				Labeled?			I		
Silica Gel Con	dition				Sealed?					

Check COC for Sample IDs of Media Blanks

Final Final Set Post-Test Set	Pass / Fail yes / no	GSOT NOT OPERATOMIK. (BEAD MG DP.	-		M
Mid-Point yes / no yes / no yes / no	yes / Fail yes / no ne				Max Temp
K Factor 34 Initial I I I I I I I I I I I I I I I I I I I	yes yes SAMPLE TRAIN VAC (in Hg)	ה ה ה ל ל ל	manu una an	mm mm	Max Temp Max Vac Max Ten S. 9 6 EPA Method 0011 from EPA SW-846
() (in Hg) (ck smp	Pass/Fail (+/- 2°) Temp Change Response CHITER (MPINGER BOX TEMP EXIT TEMP (F) (°F)	227.62	323929444	600	Max Temp 6
dehyde Leak Checks Sample Train (ft³) Leak Check @ (in Hg) Pitot good Orsat good Arenp Check Meter Box Temp Reference Temp	Pass/Fail (+/- 2°) Temp Change ReFILTER IMI BOXTEMP EX (F)	25.7	アンドラ かん すんれん	77777777777777777777777777777777777777	Min/Max
- Formaldehyde 8 1.016 1.591	180 1 PROBE TEMP (°F)	220 230 240 240 250	55 55 55 55 55 55 55 55 55 55 55 55 55	24.0 24.0 23.3 23.3 23.3 24.0	Min/Max Min/Max
	DGM OUTLET TEMP (F	<u> </u>	201 204 204 205 205 205 205 205 205 205 205 205 205	100 100 100 100 100 100	Avg Tm
*EPA Method 0011 Weter Box ID Weter Box Y Weter Box Oel H Probe ID / Length Probe Material Proto Material Proto Material Proto Material Proto ID / Length	e Pis Pam inlet Temp (PF)	100 g	373777md	21-7 21-7 21-7 21-7 21-7 21-7 21-7 21-7	Ave —
*EPA Methom Meter Box ID Meter Box ID Meter Box Y Meter Box Del H Probe ID / Length Probe Material Priot / Thermocouple ID Priot Coefficient Nozzle ID Avea of Stack (ff?)	Sample Time Total Traverse Pts STACK DGI TEMP (°F) TE	151 051 081 081	C 7 6 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	2007 1771 1771	Avg Te
Actual	DRY GAS METER READING (ft ³)	4326 448, 9 459, 9 450, 9 481, 7	492.5 503,7 514.5 536.5 536.5 556.0 556.0 576.0	6013 6433 623.31	Total Voluble [9 6.573
Stack Conditions Stack Conditions Assumed Assum	(°F) 40 ORIFICE PRESSURE Delta H (in HZQ)	3.26 3.63 1.90 3.26 2.90	3.26 3.26 3.26 3.26 3.40 3.40 3.40 3.40 3.40 3.40 3.40 3.40	3 26 3 26 3 26 3 26	Avg Delight 3,1811 Avg Sqrt Del H (
SOKIN & FIC FIELD DATA SHEET	Ambient Temp (°F) VELOCITY PRESSURE Delta P (in H20) Delta	0.09	0.09 0.09 0.09 0.09 0.09 0.09	0.08	Avg Sqri Delta P
1C FIELD DA USAF/EOM 20054.006.001.2000 AF A LMF119 12SEP2000 12-Sep-00	COCK TIME (plant time)	10000000000000000000000000000000000000	10,70 10,70 10,30 10,50 10,50 10,50 10,50	CO.	5
TIC SON	SAMPLE SAMPLE TIME (min)	5 3 25 62	20 20 20 20 20 20 20 20 20 20 20 20 20 2	02/0/2/2/2/2/2/2/2/2/2/2/2/2/2/2/2/2/2/	
Client W O.# Project ID Mode/Source ID Samp. Loc. ID Run No. ID Test Method ID Date ID Source/Location Sample Date	Baro. Press (in Hg) Operator Transfer S TRAVERSE S FOINT NO				

*EPA Method 0011 - Formaldehyde

Client	_	USAF/	EQM		W.O. #		20054.0	06.001.2000		
Location/Pl	ant	Lockheed N	Martin GA	Source	e & Location			F119-PW-100)	-
Run No. Sample I.D.	1 AF - A - I MF	119 - 1 - M001	1 - 12SEP2000		Sample Date	12-Sep-00	-		ery Date	12Septo
RIMIX	90 ml	1 50M	175W)					Filter	Number	
	1	2	3	4	Imping 5	6	7	Imp.Total	8	Total
Contents	DNPH	DNPH	DNPH					mp.rota	Silica Gel	Total
Final	107	118	92						33 6.0	
Initial	100	100	100						300	
Gain	7	18	-8					17	36.6	53.6
Impinger Col	or –	eller			Labeled?		7			
Silica Gel Co		12 blue			Sealed?					
Run No.	2			•	Sample Date	12-Sep-00		Recove	ery Date	
Sample I.D.	AF - A - LMF	119 - 2 - M0011	I - 12SEP2000		Analyst			Filter N	lumber	
!					Impinge					
Contents	1 DNPH	2 DNPH	3 DNPH	4	5	6	7	Imp.Total		Total
		DINFIT	DINFH						Silica Gel	io estado
Final	Jes						•			· · · · · · · · · · · · · · · · · · ·
Initial	100	100	100						300	
Gain								+		
Impinger Cold	or				Labeled?					
Silica Gel Cor	ndition				Sealed?					
Run No.	3			;	Sample Date	12-Sep-00		Recove	ry Date	
Sample I.D.	AF - A - LMF119 - 3 - M0011 - 12SEP2000 Analyst Filter Number									
					Impinge					
Contents	1 DNPH	2 DNPH	3 DNPH	4	5	6	7	Imp.Total	8	Total
	DIALLI	DIALU	DINPH						Silica Gel	as s
Final							· - · · · · · · · · · · · · · · · · · ·			
Initial	100	100	100						300	
Gain										
Impinger Colo					Labeled?					
Silica Gel Con	dition		_		Sealed?					

Check COC for Sample IDs of Media Blanks

CXTESTIGETY.

	, (, , , , , , , , , , , , , , , , , ,) 	•	-			,		,	-					
INOCI		FIELD	ISOMINE HIC FIELD DATA SHEET	HEET		*EPA	*EPA Method 001	-	Formaldehyde	dehvde		Page		_	
Client W.O.#	200	USAF/EQM		Stack Conditions	_	Meter Box ID	,					K Factor		 	
Project ID		AF	% Moisture	Assumed	med Actual	Meter Box Y	' <u>-</u>	1.016	1.016	100		1/ 5.0 O. 4 //	11.71	i	
Mode/Source ID		2	Impinger Vol (ml)	(ml)		Probe ID / Length	l j	2	4	Sample Train (ft ³)	(# ₃)	12	Mid-Point	rinal 0,84	ı
Run No.ID		1 1 3	Silica gel (g) CO2, % by Vol	9)		Probe Material Pitot / Thermocouple ID	f Cl along	Boro		Leak Check @ (in Hg)	g (in Hg)	\sqcup		7	1 '
Test Method ID		M0011	02. % by Vol	[']	ام	Pitot Coefficient	. I	0.84		Orsat good	ı	ves / no	yes / no	WA yes / no	,
Date ID Source/Location	•	12SEP2000	12SEP2000 Temperature (°F)			Nozzle ID				Temp Check	٠ .	Pre-Test Set		Post-Test Set	,
Sample Date		13-Sep-00	Static Press (in H ₂ O)	is (in H ₂ O) - 10		Avg Nozzle Dia (in)	ia (in)	6.3	303	Meter Box Temp	· -				, ,
Baro. Press (in Hg)	[위	48.90		1	2	_ Area of Stack (ft*) Sample Time	(<u>+</u>)	4 2		Reference Temp	₽ %				1
Operator		K4.C	Ambient Temp (°F)	этр (°F)		Total Traverse Pts	Pts .			rass/raii (+/- z.) Temp Change Response	∠ / Response ′	Pass / Fall		Pass / Fail	
TOAVEDEE	CAMBIE		The Section of the Section of		Sign of the same o	A Caust 1	Harry States	care of a a			asuodsau	yes i no		yes / no	, 100
POINT	TIME (min)	(plant time)	E VELOCITY PRESSURE Delta	ORIFICE Ita PRESSURE	DRY GAS METER RFADING (#3)	STACK	DGM INLET	DGM	PROBE	FILTER	IMPINGER	SAMPLE		Carlo Services	
O.	C		P (in H2O)	ă		TEMP (°F)	TEMP (°F)	TEMP (°F)	TEMP (°F)		EXII IEMIP (PF)	TRAIN VAC (in Hg)		COMMENTS	
	2	2,5	0/1/		623.588				À						
	3 5		· •	21.7	636.4	Q,	2	20	232	8 70	62	17			
	360	11.20	77.00	•]	6.46.9	193	202	103	25.8	248	29	7.7			
	25			٦.	652.5	193	00	103	6	247	19	3.2			
	36		25.00	27.7	7	16.2	0.7	103	त्र	218	63	32			
	200	. -	649	2.79	678.3	707	20	701	Y	248	20	3.4			
	36	9	1	3.66	688.3	19%	10.7	103	253	247	53	3,4			
	9 3	1	1	2.5%	698.3	194	201	9	253	27/2	S	3,2			
		14.50	30	77.7	208.6	195	707	103	ングン	246	28	32			
	3 6	14. 40	200	1	718.4	ah	10.2	103	255	278	09	3 2			
	200	05:71	_	2,85	7242	~	107	य	253	246	00	3.2			
	9	20.5	55.0	1	239.5	92	98	701	256	248	62	3,2		-	
	077	37.10	2.7	2.85	250.2	196	108	707	257	248	63	3.2			
	130	13,20	0 45	2.92		148	90	150	256	246	62	J	15	570 From 13	
	3/3	4	2									,	110	Vmc = 753	~
	750	4	7										- 50	Doug clarkat	 U
	09	1	١										ילו <u>.</u>	3.1	
	2,5	# 200	2												
	180	100	1												
													-		
									1		1				
													1		
								+					+		
			/\		\-\-\-\-\-\-\-\-\-\-\-\-\-\-\-\-\-\-\-	7		\					-		
W/47	7		Avg Sout Delfa P	-	Total Volume	Avg Ts (QU/ 4/6)	Avg Tm		Min/Max	Min/Max M	Max Temp	Max Vac Max	Max Temp		•
Same of the same o				Avg Sqrt Del H	Comments:	-ra-			(1)	d3 0) 1/1/	A Method 00	EPA Method 0011 from EPA SW-846	846 1	JAN	
				ı										.// //	

*EPA Method 0011 - Formaldehyde

Client	_	USAF	/EQM		W.O. #		20054.00	6.001.2000					
Location/PI	ant	Lockheed	Martin GA	Source	e & Location	1 !	ntermediate	F119-PW-1	00	_			
Run No.	1				Sample Date	13-Sep-00	<u>.</u>	Recov	ery Date	13Sept			
1		119 - 1 - M001	1 - 12SEP200	20	Analyst	<u>Em3</u>	-	Filter I	Number				
Rimse	90	1.40	150	1	Imping								
Contents	1 DNPH	2 DNPH	DNPH	4	5	6	7	Imp.Total		Total			
Final	100	110	102						Silica Gel				
Initial	100	100	100		-				300				
Gain	14	10	2		·			28	25,6	536			
Impinger Col	or _	1/2 blue	4		Labeled?								
Silica Gel Co	ndition	yellon	ريع		Sealed?					- -			
Run No.	_2				Sample Date	12-Sep-00		Recove	ery Date				
Sample I.D.	AF - N - LMF	119 - 2 - M001	1 - 12SEP200	0	Analyst		_	Filter I	Number				
		7	·	,	Imping	ег							
Contents	1 DNPH	2 DNPH	3 DNPH	4	5	6	7	Imp.Total		Total			
Final	DIV. 11	Ditrit	DIVER						Silica Gel	Des Paris de Santa			
Initial	100	100	100							,			
Gain		100	100				- ·		300				
Impinger Cold	<u>. </u>		L	L.,	1 - 5 - 1 - 10		1	<u></u>		<u>L</u>			
Silica Gel Cor					Labeled?	 							
Silica Gel Col	idition				Sealed?								
Run No.	3			2	Sample Date	12-Sep-00		Recove	ery Date				
Sample I.D.	AF - N - LMF1	19 - 3 - M0011	- 12SEP2000	- 12SEP2000 Analyst Filter Number									
					Impinge								
Contents	1 DNPH	2 DNPH	3 DNPH	4	5	6	7	Imp.Total	8	Total			
Final		DIVITI	DINFH						Silica Gel				
Initial	100	100	100						·				
Gain		100	100						300				
Impinger Colo					Labeled?								
Silica Gel Con					Sealed?								
· · · · · · · · · · · · · · · · · · ·													

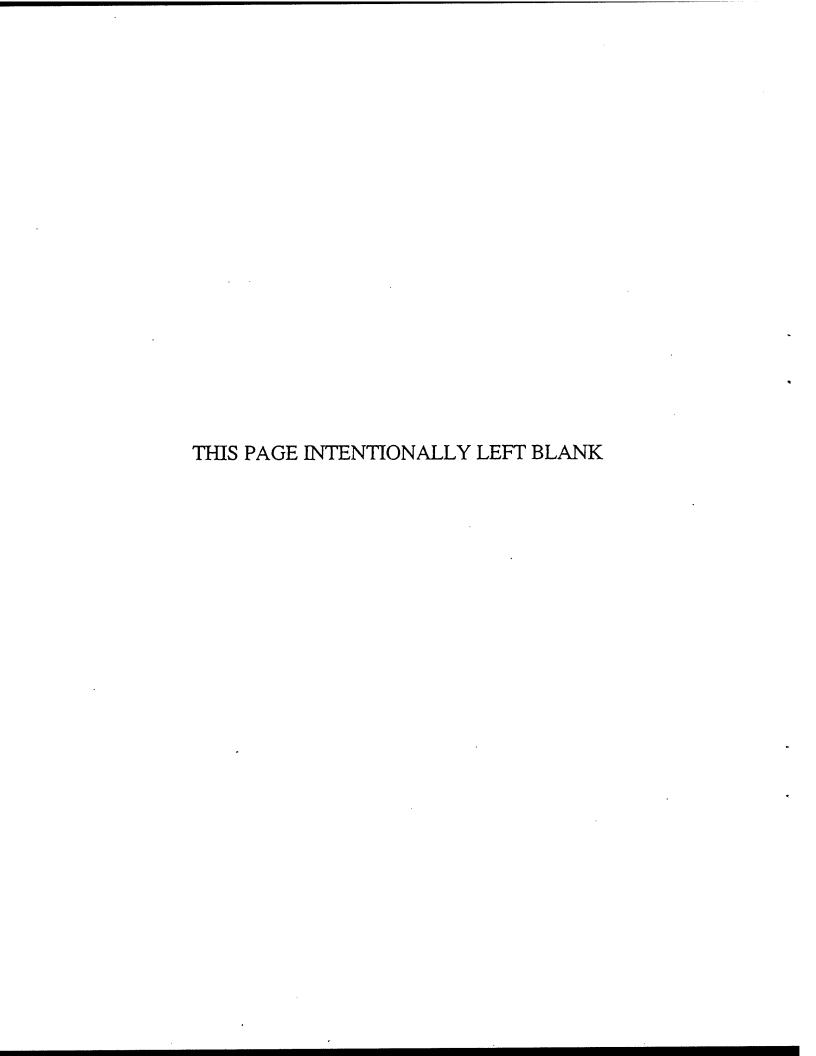
Check COC for Sample IDs of Media Blanks

Final	VA yes / no	Post-Test Set	Pass / Fail	yes / no	COMMENIS		Tap	1. 00 cl cl c	1111	11:10 ×	dats	STOD vol. = 814.	12	Stop Time at 11;		STO, V.1. : 855	Sty Clak: 47.4	Stee Line	Z		Stopped rua	27:75	\ †	886.316				<	\\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\
Page 1 of 2 18 18 18 18 18 18 18 18 18 18 18 18 18	yes / no yes / no	Test	Pass / Fail	yes / no			٠, 	7	みしみ	1		-8-	\$	ς		15 -	- bt	- 50			<u>\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ </u>	FA	- 6	ś				Max Temp	PA SW-846
κ Factor Initial	Ves / 10	Pre-			SAMPLE TRAIN VAC (in Hg)	5%	45/	27.	1-	U.7	4.7	644	50	4.7	17.6	14,5	7.5											Max Vac	EPA Method 0011 fron EPA SW-846
ks (#3)	(in Hg)	ck emp	етр - 2 ⁰)	e Rėsponse	IMPINGER EXIT TEMP (°F)	60	53	2/2	1/2	09	79	2 mg	23	09	カツ	70	69											May Temp	EPA Method
dehyde Leak Checks Sample Train (ft³)	Leak Check @ (in Hg) Pitot good Orsat good	Temp Check Meter Box Temp	Reference Temp Pass/Fail (+/- 2°)	Temp Change Response	FILTER BOX TEMP (F)	744	243	227	244	742	24	- Table 2	244	246	244	245	242										_	MinAge	1
- Formaldehyde 8 1.016 1.591 Leak Check	Boro 0.84	175.0	180	1	PROBE TEMP (°F)	/ からて	252	227	27.53	252	1251	2	25.5	253	259	1251	252										Γ	N TO SERVICE STATE OF THE SERV	150
1 1 1 1		2			DGM OUTLET TEMP (°F)	h6	455	26	96	960	96	1	23	60)	103	701	201											Wg Tm	
Лethod н	l couple ID nt	a (in)	(ft²)	Pts	DGM INLET TEMP (°F)	9,6	(0)	3 5	8	102	103	JOI THE TOP	601	(U)	C01	11.1	m	-										0	
	Probe Material Pitot / Thermocouple ID Pitot Coefficient	Nozzle ID Avg Nozzle Dia (in)	Area of Stack (ft²) Sample Time	Total Traverse Pts	STACK TEMP (°F)	376	240	77,	25.	250	252	DEC.	255	322	325	255	256						-				> ,	146.94	
Actual			7		DRY GAS METER READING (ft') 753,557	764.0	274.8	745.9	806,0	1 1	1828	4 6.858 d	50.58	860.9	871.9	882.9	886.316										>	35, 75°	Comments:
Stack Conditions Assumed Assumed			H ₂ O) -0.4		ORIFICE DI PRESSURE Delta H (In H2O)	3.20	200	100		7	3,04	3.	3.12	3.08	3.16	3.08	3.00									1			Avg Sqrt Del H Cor
ATA SHI	Silica gel (g) CO2, % by Vol O2, % by Vol	- 1 1	Static Press (in H ₂ O)	Ambient Temp ("F)	VELOCITY PRESSURE Delta P (in H2O)	0,83	27.0	2000	0.08	0.85	0.79	0.62	0,81	0 KI	0.82	0.80										/	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	0.81765	
FIELD USAF/EQM 54.006.001.200 AF	LMF119 1 M0011	12SEP2000 Military F119-PW-100	38,64	1	CLOCK TIME) (plant time) P	74.01	750	07:11	11.20		SO 14.05	41.11.18	\25.M-	のこれが	1 5 :00	01.51	15,20												Ž ssa
TETA =	- 0		्य ।		SAMPLE TIME (min)	g	2028	1 05	20	S	10 RC	80	B	100	1110	071	130	07-1	150	140	25	120							PESCHEROMATIMIS
ISOKINETIC Client W.O.# Project ID Mode/Source ID	Samp. Loc. ID Run No.ID Test Method ID	Source/Location	Baro. Press (in Hg)	Operator	TRAVERSE POINT NO																							W/1=	

*EPA Method 0011 - Formaldehyde

Client	-	USAF/EQM W.O. # 20054.006.001.2000											
Location/Pla	ant _	Lockheed M	Martin GA	Source	e & Location		Military	F119-PW-100		_			
Run No.	_1_				Sample Date	14 13-Sep-00	•	Recove	ery Date	9-14-06			
Sample I.D.	AF - M - LMF	- 119 - 1 - M001	1 - 12SEP200	0	Analyst	ist		Filter I	Number	-			
					Imping								
	1	2	3	4	5	6	7	Imp.Total	8	Total			
Contents	DNPH	DNPH	DNPH						Silica Gel	100000000000000000000000000000000000000			
Final	122	116	18						28€	74			
Initial	100	100	100		-				300	1			
Gain	22	16	-2					136	27-4	63,4			
Impinger Cole	or				Labeled?			-	·	_			
Silica Gel Co	ndition				Sealed?					-			
Run No.					Sample Date	12-Sep-00		Recove	ery Date				
Sample I.D.	AF - M - LMF	119 - 2 - M001	1 - 12SEP2000)	Analyst			Filter N	Number				
					Imping	er							
	1	2	3	4	5	6	7	Imp.Total	8 .	Total			
Contents	DNPH	DNPH	DNPH						Silica Gel	1000			
Final													
Initial	100	100	100						300				
Gain			-	·	<u> </u>								
Impinger Cold	or				Labeled?								
Silica Gel Cor	ndition				Sealed?					-			
Run No.	3				Sample Date	12 500 00		Danne	D-4-				
Sample I.D.		119 - 3 - M0011	I - 12SEP2000		Analyst	12-3ep-00	•		ery Date lumber				
•				, 	Imping	ar		T INCOLO	- Tuniber				
	1	2	3	4	5	6	7	Imp.Total	8	Total			
Contents	DNPH	DNPH	DNPH				· · · · · · · · · · · · · · · · · · ·	777	Silica Gel	Total			
Final													
Initial	100	100	100						300				
Gain													
Impinger Colo	r				Labeled?					_			
Silica Gel Con	dition				Sealed?								

APPENDIX B PARTICULATE ANALYTICAL RESULTS





ANALYTICAL DATA QUALITY PACKAGE PREPARED BY PHILIP ANALYTICAL

PROJECT 196995

FOR Roy F. Weston, Inc.

SAMPLED: September 12, 2000

CLIENT CONTACT: Pete Virag

00001

Philip Analytical Services Data Deliverables Package TABLE OF CONTENTS

SECTION	PAGE NUMBER
Title Page/Sample Key	4
Chain of Custody	6
Internal Chain of Custody Records	12
Methodology Summary	
Laboratory Chronicle	20
Case Narrative/Non-Conformance Summary Report	25
Analytical Sample Results for All Parameters/Final Report	

2-3

~100

Title Page/Sample Key

	46
	Lan
	sample ID
AF-A-LMF119-1-MZ02-12SEPZ000-FHA, FILT #638, BHC, BHS	1420084
AF-A-LMF119-2-M202-12SEP2000-FHA, FILT #637, BHC, BHS	1420085
AF-A-LMF119-3-M202-12SEP2000-FHA, FILT #636, BHC, BHS	1420086
COMP: AF-A-LMF119-1-3-M202-12SEP2000-FILT #636, 637, 638	1420087
AF-I-LMF119-1-M202-12SEP2000-FHA, FILT #641, BHC, BHS	1420088
AF-I-LMF119-2-M202-12SEP2000-FHA, FILT #640, BHC, BHS	1420089
AF-I-LMF119-3-M202-12SEP2000-FHA, FILT #639, BHC, BHS	1420090
AF-I-LMF119-SB-M202-12SEP2000-ACE, FILT #642, DCM, DIH2O	1420091
COMP: AF-I-LMF119-1-3-M202-12SEP2000-FILT #639, 640, 641	1420092
AF-M-LMF119-1-M202-12SEP2000-FHA, FILT #634, BHC, BHS	1420093
AF-M-LMF119-2-M202-12SEP2000-FHA, FILT #633, BHC, BHS	1420094
AF-M-LMF119-3-M202-12SEP2000-FILT #635	1420095
COMP: AF-M-LMF119-1-3-M202-12SEP2000-FILT #633, 634, 635	1420096
AF-N-LMF119-1-M202-12SEP2000-FHA, FILT #632, BHC, BHS	1420097
AF-N-LMF119-2-M202-12SEP2000-FHA, FILT #631, BHC, BHS	1420098
AF-N-LMF119-3-M202-12SEP2000-FILT #630	1420099
COMP: AF-N-LMF119-1-3-M202-12SEP2000-FILT #630, 631, 632	1420100
Filter W646	1421165
Filter W647	1421166
Filter W648	1421167

Chain-of-Custody

Lab	Tracking	Number	
191	.990		

Lab ID



Chain-of-Custody Record/Lab Work Request Client USAF/EQM, Lockheed Martin GA Work Order Number 20054.006.001.2000 Phone Number 610-701-7327 Contact Person Pete Virag **Turn Around Time** Standard Analyses Requested/Other Info Analysis Sample Filter Collection Sample Field Sample ID Date Check-off AF - A - LMF119 - 1 - M202 - 12SEP2000 - FHA 9/12/00 M202 638 AF - A - LMF119 - 1 - M202 - 12SEP2000 - FILT 9/12/00 M202 AF - A - LMF119 - 1 - M202 - 12SEP2000 - BHC M202 9/12/00 AF - A - LMF119 - 1 - M202 - 12SEP2000 - BHS 9/12/00 M202 AF - A - LMF119 - 2 - M202 - 12SEP2000 - FHA 9/12/00 M202 AF - A - LMF119 - 2 - M202 - 12SEP2000 - FILT 9/12/00 M202 637 AF - A - LMF119 - 2 - M202 - 12SEP2000 - BHC M202 9/12/00 AF - A - LMF119 - 2 - M202 - 12SEP2000 - BHS 9/12/00 M202 AF - A - LMF119 - 3 - M202 - 12SEP2000 - FHA 9/12/00 M202 AF - A - LMF119 - 3 - M202 - 12SEP2000 - FILT 9/12/00 636 M202 AF - A - LMF119 - 3 - M202 - 12SEP2000 - BHC 9/12/00 M202 AF - A - LMF119 - 3 - M202 - 12SEP2000 - BHS 9/12/00 M202

M5 - Gravimetric Anal Weigh all fraction weigh filters =	lysis per EPA Method 5 for for some some some some some some some some	ront half and EF of 9 five 1 by place ght 9 he	PA Method 20 Place by My Runs 1 3 filts	12 for Back Half slande 1-3 fictors	posither on the	before
Relinquished By	Received By	Date	Time		Lab Use Only	

Relinquished By	Received By	Date	Time	L	ab Use Only
Ktom	Startte	19 6000	1100	Shipper PAS	Air Bill #
	Trace	9-19-00	1435	Opened By Quar	Date/Time
	-0			Temp °C 28	Condition vilaet
				Custody Seals: Yes	
barnton: Commente:	!	·		Touciou, coulo: Tes	No None NA

Iboratory Comments:

Notes:

Lab	Tracking	Number

196995

Laboratory Comments:

Chain-of-Custody Record/Lab Work Request



Client USAF/EQM, Lockheed Martin GA
Work Order Number 20054.006.001.2000 Phone Number 610-701-7327
Contact Person Pete Virag Turn Around Time Standard

			Analyses Requested/Other Info			Info	Ī		
Lab ID		Field Sample ID		Sample Collection Date	Analysis	Filter#			Sample Check-off
	AF - I - LMF119	- 1 - M202 - 12SEP2000 - FHA	***************************************	9/12/00	M202		<u> </u>		
	AF - I - LMF119	- 1 - M202 - 12SEP2000 - FILT		9/12/00	M202	641			
	AF - I - LMF119	- 1 - M202 - 12SEP2000 - BHC		9/12/00	M202				
	AF - I - LMF119	- 1 - M202 - 12SEP2000 - BHS		9/12/00	M202				
	AF - I - LMF119	- 2 - M202 - 12SEP2000 - FHA		9/12/00	M202				
	AF - I - LMF119	- 2 - M202 - 12SEP2000 - FILT		9/12/00	M202	640			
	AF - I - LMF119	- 2 - M202 - 12SEP2000 - BHC		9/12/00	M202	1			
	AF - I - LMF119	- 2 - M202 - 12SEP2000 - BHS		9/12/00	M202				
	AF - I - LMF119 -	- 3 - M202 - 12SEP2000 - FHA		9/12/00	M202				
	AF - I - LMF119 -	- 3 - M202 - 12SEP2000 - FILT		9/12/00	M202	639		· · · · · · · · · · · · · · · · · · ·	
-	AF - I - LMF119 -	- 3 - M202 - 12SEP2000 - BHC		9/12/00	M202			T.1	
		- 3 - M202 - 12SEP2000 - BHS		9/12/00	M202		1		
	AF - I - LMF119 -	- SB - M202 - 12SEP2000 - AC	E	9/12/00	M202				
		- SB - M202 - 12SEP2000 - FIL		9/12/00	M202	642			ļ
		- SB - M202 - 12SEP2000 - DC		9/12/00	M202	1	 		
	AF - I - LMF119 -	- SB - M202 - 12SEP2000 - DIF	120	9/12/00	M202		1		
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		Analysis per EPA Method 5 for fractions TO 0.0 x Inilianily follow to obrain a Compo	red obs Place		ve place	balon	ka. ether or	the bul	ince
Relina	uished By	Received/By	Date	Time	T		b Use Only		
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Custody Seals: Yes No None N/A

Lab Tracking Number	
196995	

Chain-of-Custody Record/Lab Work Request



Client USAF/EQM, Lockheed Martin GA
Work Order Number 20054.006.001.2000 Phone Number 610-701-7327
Contact Person Pete Virag Turn Around Time Standard

	Contact Perso	on	Pete	Virag	Turn Arou	ınd Time	Sta	ndard]
	· 				Analy	yses Requ	ested/Othe	r Info]
Lab ID		Field Sample ID		Sample Collection Date	Analysis	Filter #			Sample Check-o
	AF - M - LMF1	19 - 1 - M202 - 12SEP2000 - FHA		9/13/00	M202	 			1
		19 - 1 - M202 - 12SEP2000 - FILT	***********	9/13/00	M202	634			
		19 - 1 - M202 - 12SEP2000 - BHC		9/13/00	M202			<u> </u>	
	AF - M - LMF11	19 - 1 - M202 - 12SEP2000 - BHS		9/13/00	M202				†
	AF - M - LMF11	19 - 2 - M202 - 12SEP2000 - FHA		9/13/00	M202				†
	AF - M - LMF11	19 - 2 - M202 - 12SEP2000 - FILT		9/13/00	M202	633			1
	AF - M - LMF11	9 - 2 - M202 - 12SEP2000 - BHC		9/13/00	M202				1
	AF - M - LMF11	9 - 2 - M202 - 12SEP2000 - BHS		9/13/00	M202				1
	AF - M - LMF11	9 - 3 - M202 - 12SEP2000 - FHA		9/13/00	M202				
		9 - 3 - M202 - 12SEP2000 - FILT		9/13/00	. M202	635			
***************************************		9 3 M202 12SEP2000 BHC		9/13/00	M202	102.			
	<u> </u>	9 - 3 - M202 - 12SEP2000 - BHS		9/13/00	M202	<u> </u>	 	 	
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s:	M5-Gravimetric	Analysis per EPA Method 5 for from Aracticas to 0.0 (mg vs. ALTES INDIVIDUALLY for when to optain a map	nt half and EF	A Method 20 A MANE PHING	2 for Back I Fulunce Rus 1-	talf	es Togo	ther on	The
Relingu	bala ished By	Received By 11	Date	Time 7	4 3	ALTER S	h Hoo Oak		
75.0	2	1 1 1 1 1 1 1 1			Δ		b Use Only	<u> </u>	
	<u>/</u>	Compos Alles	18 pozon	11000	Shipper P	D come	Air Bill #		
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\7X/\2 		may!	2/14/05		Opened By	they	Date/Time		
\7X/\2 		may 1	9/14/00		Opened By Temp °C	28	Date/Time Condition	inte	:X

Lab Tracking	Number
1969	95

Laboratory Comments:

Chain-of-Custody Record/Lab Work Request



Client USAF/EQM, Lockheed Martin GA Work Order Number 20054.006.001.2000 Phone Number 610-701-7327 **Contact Person Turn Around Time** Pete Virag Standard Analyses Requested/Other Info Analysis Sample Collection Filter Sample Lab ID Field Sample ID Date Check-off AF - N - LMF119 - 1 - M202 - 12SEP2000 - FHA 9/13/00 M202 AF - N - LMF119 - 1 - M202 - 12SEP2000 - FILT 632 9/13/00 M202 AF - N - LMF119 - 1 - M202 - 12SEP2000 - BHC 9/13/00 M202 AF - N - LMF119 - 1 - M202 - 12SEP2000 - BHS 9/13/00 M202 AF - N - LMF119 - 2 - M202 - 12SEP2000 - FHA 9/13/00 M202 AF - N - LMF119 - 2 - M202 - 12SEP2000 - FILT 9/13/00 M202 631 AF - N - LMF119 - 2 - M202 - 12SEP2000 - BHC 9/13/00 M202 AF - N - LMF119 - 2 - M202 - 12SEP2000 - BHS 9/13/00 M202 AF - N - LMF119 - 3 - M202 - 123EP2000 - FHA M2020 9/13/00 AF - N - LMF119 - 3 - M202 - 12SEP2000 - FILT 9/13/00 M202 630 AF - N - LMF119 - 3 - M202 - 12SEP2000 - BHC 9/13/00 M202 **Ú** AF N - LMF119 - 3 - M202 - 12SEP2000 - BHS M202 D 9/13/00 Notes: M5 - Gravimetric Analysis per EPA Method 5 for front half and EPA Method 202 for Back Half weigh all factions to do my using a fire place balance. pyther on the palence plaint Runs 1-3 fitters Relinquished By Time Date Lab Use Only 1100 Shipper (1) Air Bill # 1435 Opened By (Ma) Date/Time Temp °C Condition intac Custody Seals: Yes

No None

MA

WE SECURITY 2) Unbroken on Outer Present on Sample Package Y or (N) COC Record Present Upon Sample Rec't Package Y or (N Sample Y or A COC Tape was: 1) Present on Outer 4) Unbroken on **WESTON Analytics Use Only** 2) Ambient or Chilled 3) Received in Good Condition (2) or N Property Preserved Holding Times ۶, 5) Received Within 4) Labels Indicate 1) Shipped or Hand Delivered Yairbill # Cooler# **WESTON Analytics Use Only** CM **Custody Transfer Record/Lab Work Request** Samples Labels and COC Record? Y or NOTES: Discrepancies Between Ref# L378 Herb ORGANIC Time L377 **BNA** Date AOV Liquid Solid Liquid Date Time Collected Collected Solid Received #/Type Container \$ | |} DATE/REVISIONS: ANALYSES REQUESTED Preservatives Refrigerator αi က် 4 Ŕ ဖ Volume Matrix Relinquished by Matrix QC Chosen (<) MS MSD Est. Final Proj. Sampling Date
Work Order # 2005 4 .006.001 . 2 000 pstught on unused firsts L372 FIELD PERSONNEL: COMPLETE ONLY SHADED AREAS ATTENTON UAYAN ONGILL Time Project Contact/Phone # Hole Mily Client ID/Description 00/2 Date Date Due First Filter FLED Edm Received by, AD Project Manager — Special Instructions: 유 RFW 21-21-001/A-7/91 S. Soil
SE. Sediment
SO. Solid
SO. Sudde
W. Water
O. Oil
A. Air
S. Drum
Solids
DL. Drum Relinquished Liquids EP/TCLP Leachate Date Rec'd 1961 Account # Wi- Wipe X - Other F - Fish JAKE MATRIX CODES: <u>.</u>

L375

L373

Internal Chain-of-Custody Records

PHILIP ANALYTICAL SERVICES INTERNAL CHAIN OF CUSTODY USE MILITARY TIME

OATE OF SAMPLE TRANSFER	R TO STORAGE:	ney 9/0/00	TIME: 1200	ву: ((a)
LAB SAMPLE ID	DATE/TIME REMOVED	ANALYSIS PERFORMED	DATE/TIME RETURNED	вү	USED ALL?
1420084-100	9900 HR S 9/20/00	Meetar 202 Meetar 5		JH, TD	W/N
1241165-67		Meethor 5		10	Y/N
					Y/N
			-		Y/N
				-	Y/N
					Y/N
					Y/N
					YIN
					YIN
					YIN
					Y/N
					Y/N
	·			i	YIN
			**		Y/N
					Y/N
					Y/N
					Y / N
					YIN
COMMENTS:		196995 Roy F. Wes	ton, Inc.		
1		1420084-1420100			
		DUE: 26-SEP-00			

Methodology Summary

METHODOLOGY SUMMARY

Philip Analytical Services Reading, Pennsylvania

ENVIRONMENTAL ORGANICS:

AQUEOUS, WASTEWATER METHODOLOGY, (REF	<u>1,3)</u> METHOD	PERFORMED
PURGEABLE ORGANICS BY GC/MS	624	()
BASE-NEUTRAL/ACIDS BY GC/MS	625	()
ORGANOCHLORINE PESTICIDES/PCBS BY GC	608	()
PURGEABLE ORGANICS BY GC	601/602	() .
MISC		()

SOIL & SEDIMENT, GROUNDWATER METHODOLOGY, (REF 2)

PURGEABLE ORGANICS BY GC/MS	8240/8260	()
BASE-NEUTRAL/ACIDS BY GC/MS	8270	()
PURGEABLE ORGANICS BY GC	8010/8020	()
ORGANOCHLORINE PESTICIDES/PCBS BY GC	8080/8081/8082	()
HERBICIDES	8151	()
EXPLOSIVES	8330/8332	()
DRO/GRO/GLYCOLS BY GC	8015, Modified	()
MISC		()

ENVIRONMENTAL METALS:

SAMPLE PREPARATION, AQUEOUS, (REF 1)	METHOD	PERFORMED			
ICAP PREP & ANALYSIS	200.7	()			
FLAME ATOMIC ABSORPTION	200.0	()			
FURNACE ATOMIC ABSORPTION	200.0	()			
MERCURY SAMPLE PREP & ANALYSIS	245.1	()			
ICAP SAMPLE PREP & ANALYSIS FLAME ATOMIC ABSORPTION	6010 3050	()			
FURNACE ATOMIC ABSORPTION		()			
MERCURY SAMPLE PREP & ANALYSIS	7471	()			
FLAME AA (AQUEOUS/NON-AQUEOUS), (REF 1, 2)					
ALUMINUM 202.1/7020		()			
ANITMONY	204.1/7040	()			

ALUMINUM	202.1/7020	()
ANITMONY	204.1/7040	()
BARIUM	208.1/7080	()
BERYLLIUM	210.1/7090	()
CADMIUM	213.1/7130	()
CALCIUM	215.1/7140	()
CHROMIUM	218.1/7190	()
COBALT	219.1/7200	()
COPPER	220.1/7210	()
IRON	236.1/7381	()
LEAD	239.1/7420	()
MAGNESIUM	242.1/7450	()
MANGANESE	243.1/7460	()
MOLYBDENUM	246.1/7480	()
NICKEL	249.1/7520	()
POTASSIUM	258.1/7610	()
SILVER	272.1/7760	()
SODIUM	273.1/7760	()
TIN	284.1/7870	()
TITANIUM	283.1	()
VANADIUM	283.1/7910	()
ZINC	289.1/7950	()

FURNACE AA (AQUEOUS/NON-AQUEOUS), (REF 1, 2)

ANTIMONY	200.9/7041	()
ARSENIC	200.9/7060	()
BERYLLIUM	200.9	()
CHROMIUM	200.9/7060	()
LEAD	200.9/7421	()
THALLIUM	200.9/7841	()
NICKEL	200.9/7520	()
SELENIUM	200.9/7741	()

ENVIRONMENTAL INORGANICS/PHYSICAL TESTING PARAMETERS

PARAMETER, (REF 1, 2, 3, 4, 5, 10)	METHOD	PERFORMED
ALKALINITY	310.1	()
AMMONIA	350.1	()
BIOCHEMICAL OXYGEN DEMAND	405.1	()
BROMIDE	320.1	(.)
CHEMICAL OXYGEN DEMAND-LIQUID	410.1/508A	()
CHEMICAL OXYGEN DEMAND-SOLID	5220	()
CHLORIDE (LIQUID/SOLID)	325.2/9252/300.0	()
COLOR (LIQUID/SOLID)	110.1/110.2	()
CORROSIVITY	SW846/CHAP 7	()
CYANIDE, TOTAL (LIQUID/SOLID)	335.3/9012/4500 CD/CE	()
EXTRACTION PROCEDURE TOXICITY	1310	()
FECAL COLIFORM	9222D	
HARDNESS	130.1	1 ()
HEATING VALUE	353.2/9200/D2015	1 ()
HEXAVALENT CHROMIUM	218.4	
MOISTURE	D2216	
NITRATE, NITROGEN (LIQUID/SOLID)	353.2/9200	1 ().
NITRITE, NITROGEN (LIQUID/SOLID)	353.2/9200	1 ()
ODOR (LIQUID/SOLID)	140.1/SM207	1 ()
OIL AND GREASE	413.1	1 ()
ORGANIC CARBON, DISSOLVED	415.1	()
ORGANIC CARBON, TOTAL	415.1	1 ()
PETROLEUM HYDROCARBONS	418.1,(REF 1,4)	1 ()
pH	150,1/9045	()
PHENOLS, TOTAL (LIQUID/SOLID)	420.2/9066	1: ()
PHOSPHORUS, TOTAL	365.1	()
REACTIVE CYANIDE	SW846/CHAP 7	()
REACTIVE SULFIDE	SW846/CHAP 7	()
REACTIVITY	SW846/CHAP 7	()
SPECIFIC CONDUCTANCE	120.1	()
SULFATE (LIQUID/SOLID)	375.4/9251/300.0	()
SULFIDE	376.1/9030	()
SULFUR	D4239	()
SURFACTANTS (LIQUID/SOLID)	425.1/SM512A	()
TCLP SET-UP	EPA 1311	()
TOTAL COLIFORM (COLILERT METHOD)	SM9223B	()
TOTAL DISSOLVED SOLIDS (LIQUID/SOLID)	160.1	()
TOTAL ORGANIC HALOGENS	9020	()
TOTAL SOLIDS	209F	()
TOTAL SUSPENDED SOLIDS	160.2	()
TOTAL VOLATILE SOLIDS	2540G	()
WATER BY KARL FISCHER	4017	()
TOTAL KJELDAHL NITROGEN	351.3	()
PHYSICAL TESTING-ASH	D3174	()
PHYSICAL TESTING-SULFUR	D4239	()
PHYSICAL TESTING-CHNO ANALYSIS	D5291	()
FECAL COLIFORM, MF	9222D	()
MISC PARTICULATE	FRA 5 EFFA J	a) (v)

INDUSTRIAL HYGIENE PARAMETERS

AIR, (REF 6, 7, 8, 9)	METHOD	PERFORMED
VOLATILE ORGANICS BY GC/MS	EPA 18M	
PESTICIDES/PCBS BY GC	TO4	()
METALS	NIOSH 7300	()
METALS	OSHA ID 121	()
METALS	OSHA ID 125G	()
METALS	40CFR, PT50, APPXG	()
MISC		()
MISC	·	()
MISC		

METHOD REFERENCES

ALL METHODS ARE MOST CURRECT VERSION AVAILABLE:

- (1) METHODS FOR CHEMICAL ANALYSIS OF WATER AND WASTE-600/4-79-002
- (2) SW846 TEST METHODS FOR EVALUATING SOLID WASTE
- (3) 40 CFR PART 136, VOL. 49, NO. 209 TEST PARAMETERS FOR THE ANALYSIS OF POLLUTANTS
- (4) AS MODIFIED BY NJDEP-BISE
- (5) STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER
- (6) EPA-450/4-87-022
- (7) 40 CFR PART 50, APPENDIX G
- (8) OSHA MANUAL OF ANALYTICAL METHODS
- (9) NIOSH MANUAL OF ANALYTICAL METHODS, (NMAM)
- (10) AMERICAN SOCIETY FOR TESTING AND MATERIALS, (ASTM) STANDARDS

Laboratory Chronicle

	Lab	Analytical	Date		Date of	Date Of
רופוט וט	Sample ID	Method	Sampled	Rec'd	Prep	Analysis
EP2000-FHA, FILT #638, BHC,	1420084		9/12/00	9/19/00		9/25/00
EP2000-FHA, FILT #637, BHC,	1420085	EPA 5	9/12/00	9/19/00		9/25/00
AF-A-LMF119-3-M202-12SEP2000-FHA, FILT #636, BHC, BHS	1420086	EPA 5	9/12/00	9/19/00		9/25/00
COMP: AF-A-LMF119-1-3-M202-12SEP2000-FILT #636, 637, 638	1420087	EPA 5	9/12/00	9/19/00		9/25/00
FILT #641, BHC,	1420088	EPA 5	9/12/00	9/19/00		9/25/00
AF-I-LMF119-2-M202-12SEP2000-FHA, FILT #640, BHC, BHS	1420089	EPA 5	9/12/00	9/19/00		9/25/00
AF-I-LMF119-3-M202-12SEP2000-FHA, FILT #639, BHC, BHS	1420090	EPA 5	9/12/00	9/19/00		9/25/00
AF-I-LMF119-SB-M202-12SEP2000-ACE, FILT #642, DCM, DIH2O	1420091	EPA 5	9/12/00	9/19/00		9/25/00
COMP. AF-I-LMF119-1-3-M202-12SEP2000-FILT #639, 640, 641	1420092	EPA 5	9/12/00	9/19/00		9/25/00
AF-M-LMF119-1-M202-12SEP2000-FHA, FILT #634, BHC, BHS	1420093	EPA 5	9/13/00	9/19/00		9/25/00
AF-M-LMF119-2-M202-12SEP2000-FHA, FILT #633, BHC, BHS	1420094	EPA 5	9/13/00	9/19/00		9/25/00
AF-M-LMF119-3-M202-12SEP2000-FILT #635	1420095	EPA 5	9/13/00	9/19/00		9/25/00
COMP. AF-M-LMF119-1-3-M202-12SEP2000-FILT #633, 634, 635	1420096	EPA 5	9/13/00	9/19/00		9/20/00
AF-N-LMF119-1-M202-12SEP2000-FHA, FILT #632, BHC, BHS	1420097	EPA 5	9/13/00	9/19/00		9/25/00
AF-N-LMF119-2-M202-12SEP2000-FHA, FILT #631, BHC, BHS	1420098	EPA 5	9/13/00	9/19/00		9/25/00
AF-N-LMF119-3-M202-12SEP2000-FILT #630	1420099	EPA 5	9/13/00	9/19/00		9/25/00
COMP: AF-N-LMF119-1-3-M202-12SEP2000-FILT #630, 631, 632	1420100	EPA 5	9/13/00	9/19/00		9/25/00
Filter W646	1421165	EPA 5		9/28/00		9/25/00
Filter W647	1421166	EPA 5		00/87/6		9/25/00
Filter W648	1421167	EPA 5		00/87/6		9/25/00
AF-A-LMF119-1-M202-12SEP2000-FHA, FILT #638, BHC, BHS	1420084	EPA 5	9/12/00	9/19/00		9/25/00
AF-A-LMF119-2-M202-12SEP2000-FHA, FILT #637, BHC, BHS	1420085	EPA 5	9/12/00	9/19/00		9/25/00
P2000-FHA,	1420086	EPA 5	9/12/00	9/19/00		9/25/00
P2000-FHA,	1420088	EPA 5	9/12/00	9/19/00		9/25/00
P2000-FHA,	1420089	EPA 5	9/12/00	9/19/00		9/25/00
	1420090	EPA 5	9/12/00	9/19/00		9/25/00
AF-I-LMF119-SB-M202-12SEP2000-ACE, FILT #642, DCM, DIH2O	1420091	EPA 5	9/12/00	9/19/00		9/25/00
AF-M-LMF119-1-M202-12SEP2000-FHA, FILT #634, BHC, BHS	1420093	EPA 5	9/13/00	9/19/00		9/25/00
AF-M-LMF119-2-M202-12SEP2000-FHA, FILT #633, BHC, BHS	1420094	EPA 5	9/13/00	9/19/00		9/25/00
AF-N-LMF119-1-M202-12SEP2000-FHA, FILT #632, BHC, BHS	1420097	EPA 5	9/13/00	9/19/00		9/20/00
	1420098	EPA 5	_	9/19/00		9/20/00
AF-A-LMF119-1-M202-12SEP2000-FHA, FILT #638, BHC, BHS	1420084	EPA 202	9/12/00	9/19/00		9/25/00
AF-A-LMF119-2-M202-12SEP2000-FHA, FILT #637, BHC, BHS	1420085	EPA 202	9/12/00	9/19/00		9/25/00
AF-A-LMF119-3-M202-12SEP2000-FHA, FILT #636, BHC, BHS	1420086	EPA 202	9/12/00	9/19/00		9/25/00
AF-I-LMF119-1-M202-12SEP2000-FHA, FILT #641, BHC, BHS	1420088	EPA 202	9/12/00 9/19/00	9/19/00		9/25/00

AF-I-LMF119-2-M202-12SEP2000-FHA, FILT #640, BHC, BHS	1420089	EPA 202		9/19/00	9/2	9/25/00
AT-I-LIMIT I 19-5-MZUZ-1ZSEPZUUU-FHA, FIL. #639, BHC, BHS	1420090	EPA 202	9/12/00	9/19/00	9/5	9/25/00
AF-I-LMF119-SB-MZ02-12SEP2000-ACE, FILT #642, DCM, DIH2O	1420091	EPA 202	9/12/00	9/19/00	13/6	9/25/00
AF-M-LMF119-1-M202-12SEP2000-FHA, FILT #634, BHC, BHS	1420093	EPA 202	ı	9/13/00 9/19/00	9/5	9/25/00
AF-M-LMF119-2-M202-12SEP2000-FHA, FILT #633, BHC, BHS	1420094	EPA 202	1	9/13/00 9/19/00	9/5	9/25/00
AF-N-LMF119-1-M202-12SEP2000-FHA, FILT #632, BHC, BHS	1420097	EPA 202		9/13/00 9/19/00	9/2(9/20/00
AF-N-LMF119-2-M202-12SEP2000-FHA, FILT #631, BHC, BHS	1420098	EPA 202		9/13/00 9/19/00	9/2(9/20/00
AF-A-LMF119-1-M202-12SEP2000-FHA, FILT #638, BHC, BHS	1420084	EPA 202	9/12/00	9/19/00	9/2	9/25/00
AF-A-LMF119-2-M202-12SEP2000-FHA, FILT #637, BHC, BHS	1420085	EPA 202	9/12/00	9/19/00	9/25/00	00/
AF-A-LMF119-3-M202-12SEP2000-FHA, FILT #636, BHC, BHS	1420086	EPA 202	9/12/00	9/19/00	9/25/00	8
AF-I-LMF119-1-M202-12SEP2000-FHA, FILT #641, BHC, BHS	1420088	EPA 202	9/12/00	9/19/00	9/25/00	00/
AF-I-LMF119-2-M202-12SEP2000-FHA, FILT #640, BHC, BHS	1420089	EPA 202	9/12/00	9/19/00	9/25/00	00/
AF-I-LMF119-3-M202-12SEP2000-FHA, FILT #639, BHC, BHS	1420090	EPA 202	9/12/00	9/19/00	9/25/00	8
AF-I-LMF119-SB-M202-12SEP2000-ACE, FILT #642, DCM, DIH2O	1420091	EPA 202	9/12/00	9/19/00	9/25/00	00/
AF-M-LMF119-1-M202-12SEP2000-FHA, FILT #634, BHC, BHS	1420093	EPA 202	9/13/00	9/19/00	9/25/00	8
AF-M-LMF119-2-M202-12SEP2000-FHA, FILT #633, BHC, BHS	1420094	EPA 202	9/13/00	9/19/00	9/25/00	8
AF-N-LMF119-1-M202-12SEP2000-FHA, FILT #632, BHC, BHS	1420097	EPA 202	9/13/00	9/19/00	9/20/00	8
AF-N-LMF119-2-M202-12SEP2000-FHA, FILT #631, BHC, BHS	1420098	EPA 202 9/13/00 9/19/00	9/13/00	9/19/00	9/20/00	00/

Particulate Weight - Filter

Particulate Weight - Filter Particulate Weight - Filter

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Wt - Acetone Probe Wt - Acetone Probe Wt - Acetone Probe

Particulate VVt. Organic Fraction	nc Fraction
Particulate Wt. Organic Fraction	ic Fraction
Particulate Wt. Organic Fraction	nic Fraction
Particulate Wt. Organic Fraction	nic Fraction
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Particulate Wt. Inorganic Fraction	inic Fraction
Particulate Wt. Inorganic, Fraction	inic₁Fraction

Case Narrative/ Non-Conformance Summary Report

Case Narrative/Non-Conformance Summary

Client Name: Roy F. Weston, Inc.

Project Name: Lockheed Martin, GA/Method 202, WO#20054.006.001.2000

PAS Project #: 196995

Today's Date: October 10, 2000

This sample delivery group consisted of 20 samples collected on September 12-13, 2000. Samples were received intact on September 19, 2000 at the Philip Analytical Services Laboratory. Samples were logged into the Laboratory Information Management System (LIMS).

The samples were prepared and analyzed for Particulate by EPA 5 and EPA 202.

The following is a summary in narrative form of the quality control results associated with the samples.

Inorganics:

Particulate-

• No problems encountered with the analysis of these samples.

Helen MacMinn, Quality Assurance Coordinator

Analytical Sample Results for All Parameters/Final Report



ENVIRONMENTAL TESTING

• EPA/NVLAP 101262-0

• AIHA ACCREDITATION NO. 100439

• NY DOH 10903 • PA DER 06-353

• NJ DEP 77678

ANALYTICAL REPORT

Client:

Roy F. Weston, Inc.

Project:

196995

Report to:

Pete Virag

Received: Reported: 19-SEP-00 18-OCT-00

Roy F. Weston, Inc.

1400 Weston Way

Building 5-1

West Chester PA 19380-1499

Copy to:

Jack Mills, Roy F. Weston, Inc.

Project Description:

Method 202: USAF/EQM, Lockheed Martin GA

WO # 20054.006.001.2000

	RESULT	<u>UNITS</u>	<u>METHOD</u>	<u>DATE</u>	ANALYST
AF-A-LMF119-1-M202-12SEP2000-FHA, FIL Lab Sample: 1420084 sampled: 12-SEP-00	T #638, BHC, BH	<u>s</u>		-	·
Particulate Weight - Filter Wt - Acetone Probe Particulate Wt. Organic Fraction Particulate Wt. Inorganic Fraction	< 0.1 1.8 0.5 1.4	mg mg mg mg	EPA 5 EPA 5 EPA 202 EPA 202	20-SEP-00 20-SEP-00 20-SEP-00 20-SEP-00	A10 A10 A10 A10
AF-A-LMF119-2-M202-12SEP2000-FHA, FIL Lab Sample: 1420085 sampled: 12-SEP-00	T #637, BHC, BH	<u>s</u>			
Particulate Weight - Filter Wt - Acetone Probe Particulate Wt. Organic Fraction Particulate Wt. Inorganic Fraction	< 0.1 1.4 1.6 3.9	mg mg mg mg	EPA 5 EPA 5 EPA 202 EPA 202	20-SEP-00 20-SEP-00 20-SEP-00 20-SEP-00	A10 A10 A10 A10
AF-A-LMF119-3-M202-12SEP2000-FHA, FILT #636, BHC, BHS Lab Sample: 1420086 sampled: 12-SEP-00					
Particulate Weight - Filter Wt - Acetone Probe Particulate Wt. Organic Fraction Particulate Wt. Inorganic Fraction	< 0.1 1.1 0.9 1.3	mg mg mg mg	EPA 5 EPA 5 EPA 202 EPA 202	20-SEP-00 20-SEP-00 20-SEP-00 20-SEP-00	A10 A10 A10 A10



ENVIRONMENTAL TESTING

• EPA/NVLAP 101262-0

• AIHA ACCREDITATION NO. 100439

• NY DOH 10903 • PA DER 06-353 • NJ DEP 77678

Client:

Roy F. Weston, Inc.

Project:

196995

RESULT

UNITS

METHOD

DATE

ANALYST

COMP: AF-A-LMF119-1-3-M202-12SEP2000-FILT #636, 637, 638

Lab Sample: 1420087 sampled: 12-SEP-00

Particulate Weight - Filter

< 0.1

mg

EPA 5

20-SEP-00

VJO

AF-I-LMF119-1-M202-12SEP2000-FHA, FILT #641, BHC, BHS

Lab Sample: 1420088 sampled: 12-SEP-00

Particulate Weight - Filter Wt - Acetone Probe

Particulate Wt. Organic Fraction

Particulate Wt. Inorganic Fraction

< 0.1 1.9 0.8

3.1

mg mg mg EPA 5 EPA 5 EPA 202

EPA 202

20-SEP-00 20-SEP-00

20-SEP-00

20-SEP-00

A10 A10

VJO

VJO

VJO

AF-I-LMF119-2-M202-12SEP2000-FHA, FILT #640, BHC, BHS

Lab Sample: 1420089 sampled: 12-SEP-00

Particulate Weight - Filter
Wt - Acetone Probe
Particulate Wt. Organic Fraction
Particulate Wt. Inorganic Fraction

2.2 0.7 1.9

< 0.1

mg mg mg

mg

EPA 5 EPA 5 EPA 202

EPA 202

20-SEP-00 20-SEP-00 20-SEP-00

20-SEP-00

OFA 0

20-SEP-00 VJO

AF-I-LMF119-3-M202-12SEP2000-FHA, FILT #639, BHC, BHS

Lab Sample: 1420090 sampled: 12-SEP-00

Particulate Weight - Filter Wt - Acetone Probe Particulate Wt. Organic Fraction Particulate Wt. Inorganic Fraction

< 0.1 2.2 0.6 1.7

mg mg mg mg EPA 5 EPA 5 EPA 202 EPA 202

20-SEP-00 02 20-SEP-00 02 20-SEP-00

00 A10 00 A10 00 A10

VJO

AF-I-LMF119-SB-M202-12SEP2000-ACE, FILT #642, DCM, DIH2O

Lab Sample: 1420091 sampled: 12-SEP-00

Particulate Weight - Filter
Wt - Acetone Probe
Particulate Wt. Organic Fraction
Particulate Wt. Inorganic Fraction

< 0.1 mg 0.3 mg < 0.1 mg 0.7 mg

EPA 5 EPA 5 EPA 202 EPA 202

20-SEP-00 20-SEP-00 20-SEP-00

20-SEP-00

01.0 01.0 01.0

VJO



ENVIRONMENTAL TESTING

• EPA/NVLAP 101262-0

AIHA ACCREDITATION NO. 100439

• NY DOH 10903 • PA DER 06-353 • NJ DEP 77678

Client:

Roy F. Weston, Inc.

Project:

196995

RESULT

UNITS

METHOD

DATE

ANALYST

COMP: AF-I-LMF119-1-3-M202-12SEP2000-FILT #639, 640, 641

Lab Sample: 1420092 sampled: 12-SEP-00

Particulate Weight - Filter

< 0.1

1.7

mg

mg

mg

EPA 5

EPA 202

20-SEP-00

VJO

AF-M-LMF119-1-M202-12SEP2000-FHA, FILT #634, BHC, BHS

Lab Sample: 1420093 sampled: 13-SEP-00

Particulate Weight - Filter Wt - Acetone Probe Particulate Wt. Organic Fraction Particulate Wt. Inorganic Fraction

mg < 0.1 2.5 mg 0.7

EPA 5 EPA 5 EPA 202 20-SEP-00 20-SEP-00 20-SEP-00

20-SEP-00

VJO VJO VJO

VJO

AF-M-LMF1 19-2-M202-12SEP2000-FHA, FILT #633, BHC, BHS

Lab Sample: 1420094 sampled: 13-SEP-00

Particulate Weight - Filter Wt - Acetone Probe Particulate Wt. Organic Fraction Particulate Wt. Inorganic Fraction

< 0.1 1.7 1.1 5.3

EPA 5 mg mg EPA 5 mg **EPA 202** mg **EPA 202** 20-SEP-00 20-SEP-00 20-SEP-00

20-SEP-00

VJO VJO **VJO**

VJO

AF-M-LMF119-3-M202-12SEP2000-FILT #635

Lab Sample: 1420095 sampled: 13-SEP-00

Particulate Weight - Filter

< 0.1

mg

EPA 5

20-SEP-00

VJO

COMP: AF-M-LMF119-1-3-M202-12SEP2000-FILT #633, 634, 635

Lab Sample: 1420096 sampled: 13-SEP-00

Particulate Weight - Filter

< 0.01

mg

EPA 5

20-SEP-00

VJO

AF-N-LMF119-1-M202-12SEP2000-FHA, FILT #632, BHC, BHS

Lab Sample: 1420097 sampled: 13-SEP-00

Particulate Weight - Filter Wt - Acetone Probe Particulate Wt. Organic Fraction Particulate Wt. Inorganic Fraction < 0.1 1.4 1.4

3.3

mg mg mg mg

EPA 5 EPA 5 **EPA 202**

EPA 202

20-SEP-00 20-SEP-00 20-SEP-00 20-SEP-00

VJO VJO VJO

VJO



ENVIRONMENTAL TESTING

DATE

• EPA/NVLAP 101262-0

RESULT

• AIHA ACCREDITATION NO. 100439

UNITS

• NY DOH 10903 • PA DER 06-353

METHOD

• NJ DEP 77678

ANALYST

Client:

Roy F. Weston, Inc.

Project:

196995

AF-N-LMF119-2-M202-12SEP2000-FHA, FILT #631, BHC, BHS Lab Sample: 1420098 sampled: 13-SEP-00

•						
Particulate Weight - Filter	< 0.1	mg	•	EPA 5	20-SEP-00	VJO
Wt - Acetone Probe	1.9	mg		EPA 5	20-SEP-00	· VJO
Particulate Wt. Organic Fraction	1.2	mg		EPA 202	20-SEP-00	VJO
Particulate Wt. Inorganic Fraction	2.3	mg		EPA 202	20-SEP-00	VJO
		, ,				

AF-N-LMF119-3-M202-12SEP2000-FILT #630

Lab Sample: 1420099 sampled: 13-SEP-00

Particulate Weight - Filter < 0.01 mg EPA 5 20-SEP-00 VJO

COMP: AF-N-LMF119-1-3-M202-12SEP2000-FILT #630, 631, 632

Lab Sample: 1420100 sampled: 13-SEP-00

Particulate Weight - Filter < 0.01 mg EPA 5 20-SEP-00 VJO

Filter W646

Lab Sample: 1421165

Particulate Weight - Filter - 0.19 mg EPA 5 20-SEP-00 VJO

Filter W647

Lab Sample: 1421166

Particulate Weight - Filter - 0.11 mg EPA 5 20-SEP-00 VJO

Filter W648

Lab Sample: 1421167

Particulate Weight - Filter - 0.18 mg EPA 5 20-SEP-00 VJO

< Indicates less than the limit of quantitation.

Inorganics Raw Data (Lachat, IC, nonautomated)

Lab No.: Client:	MINK	6995 Roy F. Weston 1-M202-12SEP2000-FHA -SEP-00 : SEP-00 14:35	, Inc. – Due: 26-SEP-01, , FILT #638, BHC, BHS	ved <u>9/2</u>	0/00 (1500 H)	RS)
Description			Inorgan	ie Fraction		
A. Sample	e Volume	wash		390 mls mls	Blank Correction	
Total:	390	ml x	2×10-6	g/ml0	008 g	
B. Tare V		15.1603	.g .g	Container	No.	•
C. Gross Dale	Weights 9/23/01 9/25/01	(1) [15.166 (2) 115.166 (3)	Date Final Gross Weight: Tare Weight: Residue Weight: Blank Weight:	(4) (5) (6) 115.16.35 115.1463 .00.22 .00.08	9 9 9 9	
D. Net W	/eights: Remarks: 		Analyst	JB /VO	<i>U</i>	

Lab No.:				Pro. No.:		2 1	2 / 20
Client:	1420084 MUNK AF-A-LMF11 Sampled: Received:	196995 9-1-M202 12-SEP-00 19-SEP-0	-1300D3666 m	on, Inc. Due: 26-SEP-0 HA, FILT #638, BHC, BHS			1/25/08
Description				Osc	janie 1	Tol	lon
A. Sample	e Volume				<u>36</u> r	nis	
			wash		150	nls	Blank Correction
Total:	180		_ml ×		_g/m1		g
B. Tare V					*		
	Continer:	107.	1515	_g	С	ontainer	No.
	Filler.			_ ^g			
	Thimble:			_g			
	Total:			_g .			
C. Gross	Weights	•		Date			
Date	9/25/06	(1) (2) (3)	107.15	3 730		(4) (5) (6)	
		(3)		— Final Gross Weight	107.	1520	
				Tare Weight: Residue Weight:	107.	1515 0005	
				Blank Weight:			
D. Net W	/eights: Remarks:						
				Analyst	JB	1 V8	

				hw nu.			
Lab No.:	142008	4 196995	Roy F. W	eston, Inc.	1	9	20/00
Client:	Chen	lade 17-5-D	-(3)	Due: 26-SE D-FHA, FILT #638, BHC, I	P-0 BHS		9/25/00
•	Recen	red: 19-SEP	-00 14:35				
Description	n			Pr	ohe	Acel	no
A. Sampl	e Volume				75	_mls	
			wash		2 5	mls	Blank Correction
Total:	10	0	ml x	3×10-4	g/ml -	.000	gg
B. Tare V	Veights	-					-
D. 12.5 (Continer:	95.4	735	_9		Container	No.
	Filler:			_9			
	Thimble:			_g			
	Total:			_9			
C. Gross Dale	Weights		0 C U 7	Date ((4)	
	9122/06	(1) (2) (3)	95.47 95.47	<u>60</u>		(5) (6)	
		ری		- Final Gross Weight:		5.4750	
				Tare Weight: Residue Weight:	4	5.4735	
				Blank Weight:		. 0018	
D. Net W	/eights: Remarks:						
				Analyst	70	s /vo	
		٠					

Description	· -			F	ilter	-6:	38
A. Sampl	e Volume					mls	
			wash			_mls	Blank Correction
Total:	· · · · · · · · · · · · · · · · · · ·		_ml× .		g/ml -		
B. Tare V	Veights				-		
	Continer:			g		Container	No.
	Filler.	0.1	9912	g			
	Thimble:			.9			
	Total:			g			
C. Gross Date	Weights 9/22/00		0.1943	Dale		(4) (5) (6)	
	- ,00	- > 474		Final Gross Weight: Tare Weight: Residue Weight: Blank Weight:			
D. Net V	Veights: Remarks						

Lab No.	1420085	196995	Roy F. Westor	, Inc.		. 1	ſ
Client:	WUNK AF-A-LMF1 Sampled: Received:	19-2-M202- 12-SEP-00 19-SEP-00	-12SEP2000-FHA	Due: 26-SEP-OCE , FILT #637, BHC, BHS t:	eived	9/20	700 25/00
Description	1			Ino	rgani	Fron	lion
A. Sampl	e Volume				375		
			wash			mls	Blank Correction
Total:	3	75	ml x	2 × 10-6	_g/ml	.00	08 g
B. Tare W	/eights			*			
	Continer:	108.	5920	_9	С	ontainer N	0.
	Filter:			_g			
	Thimble:			_ g			
	Total:			_ g			
C. Gross to Date	Weights 9 15 66 9 15 66	(2)	108.5 96 108.596	Date 7		(4) (5) (6)	
D. Net We		_ (3)		Final Gross Weight: Tare Weight: Residue Weight: Blank Weight:	(08.		
	Remarks:			Analyst	JO /	Vo	

Lab No	1420085	196995	Roy F. We	eston,	Inc.).:				
Client:	WUNK AF-A-LMF1 Sampled: Received:	19-2-M20 12-SEP- 19-SEP-	2-12SEP2000 00 : 00 14:35	O-FHA,	·FILT #	Due: 637,	26-SEP-0 BHC, BHS ut:	eived	9/3	9/25/00	1
Descriptio	n							<u>.</u>			
					<u></u>		Oiga	nic F	roll	ion	.
A. Sampl	le Volume							30	_mls		
			was	h	•			150	_mls	Blank Correction	ı
Total:		180	ml:	×				_g/ml -			_9
B. Tare V	Veights		-								
	Continer	118	376,	/	_g				Containe	r No	1
	Filter:				_g				Comanie	1 140.	
	Thimble:				_9						
	Total:				_g						
C. Gross	Weights						5.				
Date	9/23/0		•	.37			Date		- (4) (5)	 	-
		(3	•		<u>.</u> ,				(6)		-
			•		Final Tare	Gro Wei	ss Weight:	118.	377	7	_g _g
						due \	Veight:		0014	,	_ g
D. Net We	eights: Remarks	s:			Diam						_ ``
				<u> </u>			Analyst		1 .		
•							Milalyst	JP	1 V		

Lab No.: Client:	1420085 WUNK AF-A-LMF1 Sampled: Received:	196995 19-2-M202 12-SEP-00 19-SEP-00	Roy F. Westo -12SEP2000-FH		Б	о. No.: 26-SEP-(ВНС, ВН	ived (i i i	9/2	0/08 125/co
Description	n					Pro	Le A	cetore	· · · · · · · · · · · · · · · · · · ·
A. Sampl	e Volume		_wash				70	_mls _mls	Blank Correction
Total:	25	100	_ml ×	_3	X10	;-P	_g/ml -	. 0	
B. Tare W	Veights Continer: Filter: Thimble: Total:	104.	7725	.g .g				Container I	No.
C. Gross Date	Weights 9/2400 9/33/00	(1) (2) (3)	104.77	Final (ale Veight:	164	- (4) - (5) - (6) - 7743	
D. Net We	eights: Remarks:			Resid	ue Weigh	ight:		. 0017 . 0003 . 0014	3
					Α	nalyst	JB	/V8	-

Lab No.:	1420085	196995	Roy F. West	in. Inc	••			
Client:	WUNK AF-A-LMF1: Sampled: Received:			Due: A, FILT #637,	26-SEP-0 ³ BHC, BHS	eived	9	120/00 9/25/00
Description							1.2	
					12	we_	- 637	
A. Sample	e Volume		•				mls	
			wash				mls	Blank Correction
Total:			ml x			_g/ml -		g
B. Tare W	eights -				•			
	Continer:			_g		r	Container	· No
,	Filter:	0.3	0989-	_9			Container	140.
	Thimble:			g				
	Total:			_9				
C. Gross V	Veights			•	Date			
Date	91 7400 1125 100	(1) (2) (3)	0.1989	<u>7</u> <u>8</u>	Jale		(4) (5) (6)	
•	- 0	. 003	85	Final Gross	Weight:			
				Tare Weigh Residue W				<u> </u>
D. Net We	ights: Remarks:			Blank Weig	ht:			
					Analyst	HC	1 V8	

Lab N'- ·	1420086 1965	195 Roy	F. Weston, In	To.:	ived	9/20/	/co
Clier	WUNK AF-A-LMF119-3- Sampled: 12- Received: 19-9	-M202-125 5EP-00 5EP-00 1	EP2000-FHA, F: 4:35	Due: 26-SEP-O ^{Rece} ILT #636, BHC, BHS Out:		9/	25/00
Descript	ion						
				Inorgan	ic Fl	oction	<i></i>
A. Sam	ple Volume				456	mls	
			wash			mls	Blank Correction
Total:	43	50	ml x	2410-6	g/ml -	. 00	09_g
B. Tare	Weights	-	-				•
	Continer:	97.	8864	g		Container N	lo.
•	Filter:			g			
	Thimble:			.9			
	Total:			.g			
C. Gros	s Weights			Date			
Date	9/25/00	(1) (2) (3)	97.8886	, Ž		- (4) - (5) - (6)	
	·			Final Gross Weight:		.8884	·g
				Tare Weight: Residue Weight:	97	. 8864	- <u> </u>
D. Net \	Weights: Remarks:			Blank Weight:		0013	
				Analyst	J0	l Vi	

Lab *					Pro. No.:			
Clie	ARDKHZ		F. Weston, I	_	Recei	ved	91	20/00
 .	AF-A-LMF119-3- Sampled: 12-S Received: 19-S	M202-12SI EP-00	EP2000-FHA, F	Due: 20 ILT #636, B	S-SEP-0(HC,BHS <mark>Out:</mark>			9/25/60
	vecsived: 14-2	Eb-00 14	1:35				•	
Descrip	otion							
					- Org	anic	Flor	elion
A. San	nple Volume					50	mls	
			wash			150	_mls	Blank Correction
Total:	2	o 6	ml x			g/ml -		
B. Tan	e Weights					•		
	Continer:	101.	2279	_g	ı			- No.
	Filter:			_g			Containe	er No.
	Thimble:			_ ^g				
	Total:			_g	·			
	ss Weights				Date			
Date	9-23-0		101,22	93 3	Date		- (4) - (5)	
	9-23-06	(2) (3)	101.29	<u> 88</u>	,		(5) (6)	
	· · · · · · · · · · · · · · · · · · ·	•		— Final Gr	oss Weight:	101	. 228	8
				Tare We	ight:		. 227	9
				Residue Blank W			,000	7
D. Net	Weights: Remarks:			DIGIIK VV	eigiii.			
					Analyst	JB/	Vo	

Lab ¹	420086 1969	95 Roy 1	. Weston, Ir	- No.:		
	MINK			Due: 26-SEP-0 Rece LT #636, BHC, BHS	eived	9/25/60
. Ki	ceived: 19-SE	P-00 14:	35	Out:		
Descripti	on			P	ube A	etone
A. Samı	ple Volume				130	mls
			wash		25	mls Blank Correction
Total:	1	55	_ml ×	3×10-4	_g/ml -	.0005
B. Tare	Weights			•		
	Continer:	100.	4371	_9		Container No.
	Filter:			_g		
	Thimble:			_g		
	Total:			_g		
C. Gross Date	s Weights <u>9</u> /22 <u>/00</u>		100,43			- ⁽⁴⁾
	4/32/00	(2) (3)	100.43	<u>9</u> 3 -		(6)
				Final Gross Weight: Tare Weight: Residue Weight:		. 4387 . 437/ .0016
D. Net V	Veights: Remarks:			Blank Weight:		.6005 .0011 g
				Analyst	JB	14

Lab No	1420086	196995 1	Roy F. Weston,	Inc.			1. 1.
Client:	WUNK AF-A-LMF119 Sampled: 1 Received: 1	7-3-M202- 2-SEP-00 19-SEP-00	12SEP2000-FHA, 14:35	Due: 26-SEP-OCE FILT #636, BHC, BHS L:	lved		1/25/co
Description				F	iter	- 63	<u></u>
A. Sample	e Volume					mls	
			wash			_mls	Blank Correction
Total:			ml ×		_g/ml -		g
B. Tare W	leights			-			
	Continer:			g		Container	No.
	Filter:	0.1	9986	g		·	
	Thimble:			g			
	Total:			g			
C. Gross \	Weights			Doto	÷		
Date	9/2400	(1) (2) (3)	01987 0.1988	Date 7 0		(4) (5) (6)	
-		•	01069	Final Gross Weight:		_	g
			' 0	Tare Weight: Residue Weight:			9
				Blank Weight:			g
D. Net We	eights: Remarks:						
				Analyst	Jp	100	

Lab No.:	1420087	196995 Roy F. West	ion, Inc.				
Client:	WUNK COMP: AF- Sampled:	A-LMF119-1-3-M202-12S 12-SEP-00 19-SEP-00 14:35	Due: 26-SEP-0 2SEP2000-FILT #636, 637, pived			9/20/00	
	Keceived:	19-SEP-00 14:35	_	638		9	127/00
Description	n .						
			·	filter	- 636	, 637,	638
A. Sampl	e Volume					mls	
		wash				_mls	Blank Correction
Total:		ml x			_g/ml -		
B. Tare W	/eights	-					-
	Continer:	0.19984	g			Container	No.
	Filter:	6. 20287	_g			Container	140.
	Thimble:	6. 19917	_g				
	Total:	0.40180	9				
C. Gross V	Neights .			Date			
	1 26 60 9 26 60	(1) 97.589 (2) <u>0-593</u> (3)	-			— (4) — (5) — (6)	
		61213		oss Weight:			
٠	~ O·	009619	Tare We Residue Blank W	Weight:			
D. Net We	ights: Remarks:						
	•		 	Analyst	JH	100	

Roy F. West 2-12SEP2000- 00 : 00 14:35	-	ue: 26-SEP-0 11, BHC, BHS: Rece	ved	9/2	0/00
00 14:35					1 .
		J Gai.		9 6	15/00
			mie F	inter	
wa	ish				Blank Correction
) ml	x	2×10-1	g/ml -	. 00	08 9
13-43-	3 -3- _g				
			C	ontainer N	D.
	g				
	g				
		Dete			
(2)		Date .		(4) (5)	
(3)		•		•	
	Та	re Weight:	113.	4342	
		_		.0008	
				.0031	9
		Analyst	Jn.	1 12	
	(3-4 3 -3-113. 43	(3.4332 g 113.4342 g g (1) 113.4386 (2) 113.4386 (3) Fin	wash	Wash	Mash

Lab N	1420088 19				Pro. No.:			
	ी। 1km/	76995 Ro I-M202-125 SEP-00 SEP-00 1	y F. Weston, EP2000-FHA, F	Inc. Due: ILT #641,	Rece 26-SEP-0©ut: BHC, BHS I	ived		9/25/co
Descript					O) Ima	eganie rgani e	Fra	Tim
A. Sam	ple Volume					25 150	mls	
Total:	17	5	wash ml x			g/ml -	mis	Blank Correction
	Weights					• .		
	Continer:	101	0364	_9 _9			Container	No.
	Thimble: Total:			_g _g				
C. Gross Date	s Weights 9 23 66 9 23 62	(1) (2) (3)	101.63		Date		(4) - (5) - (6)	**************************************
				Tare W	e Weight:	101.0	372 364 0008	
D. Net V	veignts: Remarks:							
					Analyst	JB	1 V6	

Lab I	MUNBZ	·-00 :	Inc. Due: 26-SEP-ORecei FILT #641, BHC, BHS Sut:	ved	9/25/0
Descripti	on		Pre	the Acet	one
A. Sam	ple Volume			60 mls	
		wash		∂5mls	Blank Correction
Total:	85	ml x	3 x 10-1	g/ml - <u>'</u>	0003 g
B. Tare	Weights	*			*
	Continer: /	11.8000	_ g		
	Filter:		 g	Contain .	er No.
	Thimble:		 g		
			g		
	Total:		_		
C. Gros	9 /22/08 9 /33/00	(1) ///. 80 d (2) ///. 80 d (3)	Date	(4 (5 (6)
D. Net	Weights:	•	Final Gross Weight: Tare Weight: Residue Weight: Blank Weight:	111-802	; p. }
	Remarks:		Analyst	JB/V8	

Lab N	1420088 196995 Roy F. Westo	o.:		
Client	WUNK AF-I-LMF119-1-M202-12SEP2000-FHA Sampled: 12-SEP-00 : Received: 19-SEP-00 14:35	Dura 2/ RED Steer		20/00 9/27/00
Descript	lion	F	itler - 641	
A. Sam	ple Volume		mls	
	wash		mls	Blank Correction
Total:	ml x		_g/ml	
B. Tare	e Weights		-	
	Continer:	g		- No
	Filter: 0.2009	<u>}</u> g	Containe	r No.
	Thimble:	g		
	Total:	g		
C. Gros	ss Weights	Date	40	
	$\frac{9/27/00}{4/35/00}$ (1) $0 \cdot 20$	015	(4) (5) (6)	
	-0.00084	Final Gross Weight:		
		Tare Weight: Residue Weight: Blank Weight:		
D. Net V	Weights: Remarks:			
		Analyst	JH /V0	

20/06
9/25/00
Jou _
<u>ه</u>
Blank Correction
<i>008</i> g
No.
3 (
7
g
! 7

Lab Nr	1420089	196995	Roy F	. Weston,	Inc.).:				
Client:	WUNK AF-I-LMF1 Sampled: Received:	19-2-M202 12-SEP- 19-SEP-(2-12SEP 00 :	2000-FHA, 35	DI FILT #64	ue: 26-SEP-O o ce O, BHC, BHS ut:	lived	91	1/25/00	
Description	n									
						Org	ank	Frank	tor	
A. Sampl	e Volume	3				U	25			
				vash			150	_mls	Blank Correction	
Total:		75		nlx			_g/ml -			g
B. Tare V		-	-					•	r	
	Continer	: 114	. 41	55	_g			Container	No.	ļ
	Filter:				_ g					
	Thimble	:			_9					
	Total:		,		_g					
C. Gross Date	Weights 9/22/66 <u>9/23/6</u>) _	14,41(114.41	60 62	Date		- (4) - (5) - (6)		•
		_	٠		Tare V Residu	Gross Weight: Veight: ue Weight: Weight:	114.	4162 4155 0007		9
D. Net We	eights: Remarks	S:								•
						Analyst	TB	Vo		-

Lab N	1420089 19	/ D OC -			~~ No.:			
	MINK		F. Weston,		}ecei	ved	9/6	00/00
Client	AF-I-LMF119-2 Sampled: 12- Received: 19-	2-M202-12S SEP-00 -SEP-00 1	EP2000-FHA, 1 : 4:35	Due: FILT #640,	26-SEP-01 BHC, BHS Dut:	VCG	9	125/00
					· .			
Description	on .				\sim	1	i o	
					1 rol	~ Aw	(pu)	
A. Samp	le Volume					.50	_mls ·	
			wash			25	_mls	Blank Correction
Total:		5	_ml x	_ 3 x	10-8	g/ml -	. 0	002 g
B. Tare						•		
	Continer:	162.	7532	_g		<u> </u>	Container	No.
	Filter:			_g				
	Thimble:			_g				
	Total:			_g				
	s Weights				Date			
Date	9 12210	(1)	102.75	22.6	Detc		- ⁽⁴⁾ (5)	
	9/23/00	(2) (3)	162.7	<u>5</u>	•		— (6) — (6)	
		-			ross Weight:		a. 755	
,				Tare W	eight: • Weight:		1000	
				Blank V			.000	CD- (
D. Net V	Veights: Remarks:						. 008	92 9
				· ·				
					Analyst	JB) v	' ð

Lab No	1420089	196995	Roy F. Weston,	Inc.		.•				
	WUNK		125EP2000-FHA,	CTIT	Due:	26-SEP-0	ived	9	120/00	
Client:	AF-I-LMFII Sampled: Received:	12-SEP-0 19-SEP-0	1256P2000-FRH, 0 :) 14:35	FILL	HOTV,	at:			20/00 9/27/0°	
				-						
Description	n						<u> </u>			
						Til	tec.	640		
A. Sample	e Volume	· •						mls		
			wash					mls	Blank Correction	
Total:			ml x				_g/ml -			g
B. Tare V	Veights							•		
	Continer	•		_9		·		Containe	r No.]
	Filter:	. 0.3	0242	_9				Comanio		
	Thimble:			_g						j
	Total:	····		_g						
C. Gross	Weights					Date				
Date	9/25/	O() (2)	0.1987]]		Balc		— (4) — (5) — (6)		-
-		(3)		 Ein	al Gr	oss Weight:				- g
	- 0	. <i>0</i> 63	<i>)</i>	Tai	re We	ight:				_8 _8
					ink W	Weight: eight:				_ç
D. Net We	eights: Remarks	s:								
					-	······································				
			·			Analyst	JH	/vo		

Lab No	1420090	196995	Roy F. Weston	, Inc.		 		<u> </u>	-
Client:	WUNK AF-I-LMF11 Sampled: Received:		-12SEP2000-FHA 0 : 0 14:35	Duga	26-SEP-O/CE BHC, BHS int:	ived	9/-	20/0 0 25/0 0	
Description	n				T	· · · · ·	E, T.	a	
					I norge	enc	Fractio	<u></u>	-
A. Sampl	e Volume	•	•			37	$\frac{1}{2}$ mls		
			wash				mls	Blank Correction	n
Total:	37	15	ml x	2 x	10-4	_g/ml -	. 0	007	g
B. Tare W						-			
	Continer:	109.	3194	_9		Γ	Container	No.	7
	Filter:			_g			55		
	Thimble:			_g					_]
	Total:			_9					
C. Gross Date	Weights				Date		(4) (5)		
-		(3)		- /			(6)		
				Final Gros Tare Weig Residue V Blank We	Veight:		9.3218)	
D. Net We	eights: Remarks	:						17 g	
					Analyst	J <i>B</i>	100		

Lab N	1420090	196995	Roy	F. Weston,	Inc.		0.:			
Client	WUNK AF-I-LMF1 Sampled:	19-3-M20 12-SEP-	2-12SE 00	P2000-FHA,	FILT (Due: #639,	26-SEP-0 BHC, BHS lece	ived	9/2	0/00
	Received:	19-SEP-	00 14	:35			Sut:			03/80
			•							
Description	on						0 1	Janic.	Froi	Tiere
)		
A. Samp	ole Volum	18			•			50	mls ·	
				_wash			·	158	_mls	Blank Correction
Total:		200		_ml x				g/ml -		
B. Tare	Weights	~		سه						•
	Contine	r. <u>1</u> 6	1.4	960	g				Container N	No.
	Filter:				g				Comanici	
	Thimble	e:			g					
	Total:				g					
C. Gross	s Weights	S					Data			
Date	9/23/0	ð ((1)	101.4	969		Date		(4)	
	9/23/	106	(2) (3)	101.4	1966				(5) (6)	
	-				 Fin	nal Gi	oss Weight:	10	1.4969	0
					Ta	re W	eight: Weight:		1-496	
							Veight:			(=
D. Net V	Veights: Remar	ks:			· • - · · · · · · · · · · · · · · · · ·		·			
							Analyst		l' 14-4	
								JB	Vy	

				~··	:		
Lab N	1420090 196995	Roy F. We	eston, Inc.			912	00
Clien'	WUNK AF-I-LMF119-3-M2 Sampled: 12-SEP Received: 19-SEP	02-12SEP2000 -00 -00 14:35)-FHA, FILT #	Due: 26-SEP-O ^{le} 639, BHC, BHS Du			27/60
Descripti	ion			(Dude	Acelo	
A. Sam	ple Volume	-	,		136	mls	
		wa	sh		əs	mls	Blank Correction
Total:	155	ml	x	3×10-6	g/ml -	_ 00	05
B. Tare	Weights						
	Continer: /	18.971	2 9			Container I	
	Filter:		g			Container	10.
	Thimble:		g			<u> </u>	
•	Total:		g				
C. Gros	s Weights			Date			
Date	9/22/00	(2) 1	8.9739	Date		- (4) - (5) - (6)	
		(3)				- 8.9139	
				al Gross Weigl re Weight:	ht: 776	r. 9712	
				sidue Weight: ink Weight:		.0005	•
D. Net \	Weights: Remarks:					,0028	9
				Analys	51	1×	
				, and ye	" J8	/ V8	

La'			ŀ	Pro. No.:			
1420090	196995 Roy F	. Weston, In		e Recei	ved	9	120/00
AF-1-1 MF119	7-3-M202-12SEP 12-SEP-00 : 19-SEP-00 14:	2000-FHA, FII 35	Due: 26-SE LT #639, BHC, I	P-0 [.] ^{BHS} e Out: .			1/27/0
Description						· · · · · · · · · · · · · · · · · · ·	
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,				Fi	ther	- 639	
A. Sample Volu	ıme .		-			mls	
		wash				_mls	Blank Correction
Total:		ml x		<u>.</u>	g/ml -		
B. Tare Weight	s						•
Conti	ner:		^g			Container	No.
Filter	. 0.)	0618	g				
Thim	ble:		g		<u></u>		
Total:			g				
	(1)	0.205 0.205	57∆ 79.3	Date		— (4) — (5)	
	(3)					(6)	
	-0.00	025	Final Gross Tare Weigh		0.		
		·	Residue W Blank Weig	eight:			
D. Net Weights: Rema	arks:		Dialik VVoig		-		
		<u> </u>		Analyst	Тн	Vi	

				Dw NU.		
ab No.		5995 Roy	F. Weston, I	nc. celv	red	9/20/00
client:	WUNK AF-I-LMF119-9 Sampled: 12- Received: 19-	6B-M202-12 -SEP-00 -SEP-00 1	SEP2000-ACE, 4:35	Due: 26-SEP-0 FILT #642, DCM, DII		9/25/00
Description				Im	organic	Froten
A. Sample	e Volume				295 m	
			_wash		m	ls Blank Correction
Total:	29	5	_ml ×	395	g/ml	2 × 10 -6 g
B. Tare V	Veights					
	Continer:	106.4	1605	g	Co	ntainer No.
	Filter			9		
	Thimble:			. g	<u></u>	
	Total:	· · ·		g		
	Weights			Date		40
Date	9/23/00	(1) (2) (3)	106.46	13		(4) (5) (6)
		- (3)		- Final Gross Weight:	106.	1612
				Tare Weight: Residue Weight: Blank Weight:	106.	4605 co07
D. Net V	Veighls: Remarks:			Oldin VVolgin.		
				Analyst		LIA
					J3	/ Vo

• • • • • •				Pro. No.:		
Lat. No 142		Roy F.	Weston, Inc.	Due: 26-SEP-0 e Receiv	/ed	9/20/00
Clisci: MU AF- Sa	NK ·I-LMF119-SB-M mpled: 12-SEP	202-12SEP2	2000-ACE, FILT	Due: 26-SEP-07 #642, DCM, DI le Out: _		9/25/00
Rec	eived: 19-SEP	-00 14:35	5 .			·
Description	n _					
				Олд	ance to	raction
A. Samp	le Volume			o	40 mls	
			wash		158 mls	Blank Correction
Total:		96	_ml ×		g/ml	g
B. Tare	Weights			•	• .	
	Continer:	112.	7870	.g	Conta	ainer No.
	Filter:			g		
	Thimble:			. 9		
	Total:			g		
	s Weigh ts			Dale		
Date	9-23-60	(1)	112.786			(4)
	:	(2)		- -		(6)
				Final Gross Weight:		g
				Tare Weight: Residue Weight:		
D. Net V	Veights: Remarks:	:		Blank Weight:		
				A 1 4	,	
	9		•	Analyst	JB /V)

			n +19.;		
_ab No.:	1420091 196995 WUNK AF-I-LMF119-SB-M	202-12SEP2000-ACE, FI	Tue: 26-SEP-0 CEIV	ed	9/25/00
	Sampled: 12-SEP Received: 19-SEP	-00 14:35			
Description	·		Prohe	Acolons)_
A. Sampl	e Volume			80 mls	Blank
		wash			Correction
Total:	105	ml ×	105	g/ml	3×10-4 9
B. Tare	Weights				
	Continer: 1	05.3148	g	Cont	ainer No.
	Filter:		g		
	Thimble:		9		
	Total:		g		
C. Gros Date	9/2400 9/2400 9/33/00	(1) <u>10531</u> (2) <u>165-316</u> (3)	Date	9/22/66 9/23/00 4/25/00	(4) 105.3151 (5) 105.3150 (6)
			Final Gross Weight Tare Weight: Residue Weight: Blank Weight:	10S.	3/5/ 3/48 9 0603 9
D. Net	Weights: Remarks: _				
	- -		Analys	JB/V	1 0

ab No.	•	196995	Roy F. Weston,	Inc. Due: 26-SEP-0			1/20/00
Cilent: _	WUNK AF-I-LMF1 Sampled: Received:	19-SB-M2 12-SEP-(19-SEP-	02-12SEP2000-ACE, 00 : 00 14:35	, FILT #642, DCM, DI I	rt:	9	120/00
Description					Fitter	-642	
- A. Sample	Volume					_mls	
			wash		· · · · · · · · · · · · · · · · · · ·	mls	Blank Correction
Total:			ml x		g/ml -		
B. Tare W	eights		*				-
	Continer	:		. 9		Container	No.
	Filter:	. 0	20361	_9		Comanici	
	Thimble	:		_ 9			
	Total:	<u> </u>		_ g			
C. Gross	Weights			Date			
Date	9/22/0	00 0	1) 0,2020 2) 6,2015 3)	3"0.20231		(4) (5) (6)	
	- (<u> </u>		Final Gross Weight:			
				Residue Weight: Blank Weight:			
D. Net W	eights: Remarl	ks:					
				Anal	yst JH	/vi	

Lab	1420092 1969	95 Roy F. Weston, I	nc. Yo.:			
Clier	1 11 15 11 /	119-1-3-M202-12SEP200	Due: 26-SEP-ORece	eived	9	20/00
	Sampled: 12-9 Received: 19-9	SEP-00 : SEP-00 14:35	441 Out:			9/27/60
	American State of American Agency					
Descrip	otion			· ·		
			Filter	- 263	9,40,0	144
A. San	nple Volume		·		mls	
		wash			mls	Blank Correction
Total:		ml x		_g/ml -		9
B. Tar	e Weights			-		
	Continer:	0.20618	_ g			
	Filter:	0.20242	g		Container	NO.
	Thimble:	0.20341	_g			
	Total:	0.61221	g			
	ss Weights		Date			
Date	1126/00	(2)			— (4) — (5)	
	-	(3)			(6)	
	- 0.	003499	Final Gross Weight: Tare Weight:			
		· ·	Residue Weight:			
D. Net	Weights: Remarks:		Blank Weight:			
		·	Analyst		1	
			,	丁户	1 / 10	

		No.:		
11241-	12SEP2000-FHA, FILT #634	. 26-SEP-0Received	<u>91</u> 9	124/00
Description		Inoge	ine Frat	tion
A. Sample Volume	wash		475 mls	Blank Correction
Total: 475	ml x	2 x 10 - 4 g/	ml - <u>. ୯</u>	9
B. Tare Weights Continer: 10 Filter: Thimble: Total:	gg g g		Container	No.
C. Gross Weights Date 9/23/00 9/25/00	Ta Re	Date nat Gross Weight: ne Weight: esidue Weight: ank Weight:	(4) (5) (6) 106.528 106.525	7 9
Remarks:		Analyst	TB /V6	

Lab No	1420093 196995 Ro WUNK AF-M-LMF119-1-M202-12 Sampled: 13-SEP-00 Received: 19-SEP-00	y F. Weston, In SEP2000-FHA, FI 14:35	Tue: 26-SEP-Gecel	9/26/00
Descripti	on		O A	paris Frostin
A. Sam	ple Volume	wash		gance Frontier 50 mls 150 mls Blank Correction
Total:	200	ml ×		_g/m1g
C. Gros	Total: ss Weights $\frac{9/23/66}{9/23/66}$ (2)	164.49 104.49	_g _g _g _Date	(4) (5) (6) 104. 4628 104. 4421 . 0007
D. Net	Weights: Remarks:		Analyst	JB / Vo

Lab No.: Client:	1420093 WUNK AF-M-LMF11 Sampled: Received:	196995 9-1-M202- 13-SEP-00 19-SEP-00	Roy F. Weston 12SEP2000-FHA 14:35	Due: 26-SEP-OSIN, FILT #634, BHC, BHS	ved	9/24/00	
Description				probe	aceton	Q.	
A. Sample	a Volume		wash	100	mls		ion
Total:	125		_ml ×	3×10-4	.g/ml	.0004	g .
B. Tare V	Veights Continer: Filter: Thimble: Total:	J <i>O</i> à.	0758	.g .g	Con	tainer No.	
C. Gross Date	Weights <u>9 22/00</u> <u>4 33/0</u>	(1) (2) (3)	102.076	Date 7 7 Final Gross Weight: Tare Weight: Residue Weight: Blank Weight:		0758 0029 . vecy	g g g
D. Net W	reights: Remarks:			Analyst	TMI	1 Vo	

ler::: WUNK AF-M-LMF119-1-M20 Sampled: 13-SEP- Received: 19-SEP-	02-12SEP2000-FHA, F	Due: 26-SEP-0 Rec		21/00 (150 9/24/00
Sample Volume	wash		mls mls	Blank Correction
Cotal:	ml ×		g/ml	<u>.</u> g
Continer: Filter: Thimble: Total: C. Gross Weights Date 12400 4125 Co.	(1) 0,204 (2) 0,204	g g 	(4) ————————————————————————————————————	r No.
D. Net Weights:	(3)	Final Gross Weig Tare Weight: Residue Weight: Blank Weight:	ht:	8

				• •	•			
_ab No.:	1420094	196995 - Ro	y F. Weston,	Inc.	 	, ad	9	120/00
Client:	WUNK AF-M-LMF11 Sampled: Received:	19-2-M202-12 13-SEP-00 19-SEP-00	SEP2000-FHA, 14:35	Due: 2 FILT #633, B	26-SEP-O ^{el} \ HC, BHS -	, bu	9	126/00
Description					Ingra	janic	Fronti	on
A. Sample	Volume				0	395		•
			wash				mls -	Blank Correction
Total:	3	95	_ml x	2×10	- γ	g/ml -	- 0	010 9
B. Tare W	leights	-		•			~	
	Continer:	113,5	717	g			Container I	10.
	Filler.			. 9				
	Thimble:			. 9				·
	Total:			.g				
C. Gross Date	Weights 9 25/00 9 25/00	(1) - (2) - (3)	113,57	82	Date		— (4) — (5) — (6)	
D. Net W	eiahts:			Final Gross Tare Weigl Residue W Blank Weig	ht: /eight:	113	5780 5717 0063 .0016	3
	Remarks	:						
				·	Analyst		BIV	<u>ď</u>

Lab No.:	1420094	196995	Roy F. W	eston, Inc.	-		0.1	120100
Client:	WUNK AF-M-LMF: Sampled: Received:	19-2-M202 13-SEP-0 19-SEP-0	2-12SEP2000 0 : 0 14:35	O-FHA, FILT	Due: 26-SEP-00 #633, BHC, BHS	ved _	<u>91</u>	126/00
Description)				0,	gænle	Flor	Don
A. Sampl	e Volume					35	mls	
			_wash			150	mls	Blank Correction
Total:	18	5	_ml ×		<i>-</i>	.g/ml -		g
B. Tare V								
	Continer:	117.	1329	g			container	No.
	Filter:			g				
	Thimble:			g		<u></u>		
	Total:			g				
C. Gross Date	Weights 9/23/00	(1) (2)	117.13	340	Date		(4) - (5) - (6)	
·		(3)		Final Tare ' Resid	Gross Weight: Weight: lue Weight: Weight:	117.	1340	
D. Net W	/eights: Remarks:							
					Analyst .	JB	/ Vo	

ab No.: Client:	1420094 WUNK AF-M-LMF1 Sampled: Received:	196995 19-2-M202 13-SEP- 19-SEP-	Roy F. Weston 2-12SEP2000-FHA 00 : 00 14:35	, Inc. , FILT #4	Due: 26-SEP-0.elved 33, BHC, BHS:elved	9/21/00
Description						e arotino
A. Sample	Volume		wash		95 25	mls Blank Correction
Total:	17	20	ml ×		3 × 10 - 4 g/	/ml
B. Tare W	eights	•	*			•
	Continer:	117	1814	g	Г	Container No.
	Filter:			_9		
	Thimble:			9	<u>L</u>	
	Total:			9		
C. Gross	Weights <u>9 22 0</u> 	5c (2	·/	836 835	Date 	(4) (5) (6)
	- <u>-</u> -	- `		Tare Resi	Gross Weight: Weight: due Weight:	117.1835 117.1814 . 0021 . 004
D. Net W	/eights: Remark	:s:				· ocj 7
	9				Analyst	Im) / Vé

			•	Pm Nn.;				Ţ
Lab No.:	1420094 1	96995 R	oy F. Weston, 1	Inc.	elved	9/21	00	USO
Cilent:	WUNK AF-M-LMF119 Sampled: 1 Received: 1	7-2-M202-1 3-SEP-00 19-SEP-00	2SEP2000-FHA, 1	Due: 26-SEP-01 FILT #633, BHC, BHS (t:			26/00	,
Description	-				zilter	-633		
A. Sample	Volume					mls		
			wash			mls	Blank Correction	n
Total:			_ml×		_g/ml -			_g
B. Tare W	/eights				-			
	Continer:			g		Container	No.	7
	Filler:	0.300	016	g				
	Thimble:			.9	L			_1
	Total:		·	.9				
C. Gross	Weights		. Oc. L	Dale		(4)		
	9/2400 4125/00	(1) (2) (3)	0.19803	<u>}</u> -		(5)		
	-	. 6.00	206 g	Final Gross Weight Tare Weight: Residue Weight: Blank Weight:				a a a a
D. Net W	leights: Remarks	:						
	8			Analys	st Tmi	JVO		

± ~⁴		Pro. No.:				
1420095 196995 WUNK AF-M-LMF119-3-M202- Sampled: 13-SEP-00 Received: 19-SEP-00	12SEP2000-FILT #635	ue: 26-SEP-0(Date Rece l Date Out:	ived		100	CIST
Description		,	Filt	e(-6	35	
A. Sample Volume				mls		
	wash	•		_mls	Blank Correction	
Total:	ml x		_g/ml -			g
B. Tare Weights						-
Continer:		<u>.</u> g `		Container	No.	1
Filter:	0.19854	9				
Thimble:		g				j
Total:		^g				
C. Gross Weights Date 9/22/CC	(1) 0.1970 (2) 0.1969 (3)	Date		- (4) - (5) - (6)		- -
~ O.	001488	Final Gross Weight: Tare Weight: Residue Weight: Blank Weight:				_8 _8 _8
D. Net Weights: Remarks:						
		Analyst	JWI)	/ ν	γ	_

Labi	140000		Pro. No.:		9	20/00
Clier	Lit (Kitz	95 Roy F. Weston, In 19-1-3-M202-125EP2000 EP-00 P-00 14:35	nc. Rece Due: 26-SEP-0 O-FILT #633, 634, Out: 635	eived	9	127/00
Descrip	tion _		Filte	r - #4	33-6	3x - 635
A. San	nple Volume				mls	
		wash			mis	Blank Correction
Total:		ml x		_g/ml -		9
B. Tar	e Weights					
	Continer:	0.20016	-		Container	No.
	Filter: Thimble:	0.19854	_g _g			
	Total:	0 60396	_g			
C. Gro Date	ss Weights	(1) <u>0.599</u>	Date <u>6</u> 6		(4)	
		(2)	-		(5) (6)	
	- (Final Gross Weight: Tare Weight: Residue Weight:			9
D. Net	Weights: Remarks:		Blank Weight:			
	•		Analyst	J 4) vo	

_ab No.:	1420097 WUNK AF-N-LMF1 Sampled: Received:	10_1_M202	Roy F. Wes -12SEP2000- 0 : 0 14:35	ton, Inc. Due -FHA, FILT #63	 2, 26-SEP-OXC 2, BHC, BHS 1		9 20/00 9 26/0°
Description					Tno	iganic	Froillow
A. Sample	Volume		wash			4/0 mls mls	Blank Correction
Total:	410		_ml ×	2 1 16	- Ψ _g/	'ml	.0008 9
B. Tare W	leights			au.			
	Continer:	115.9	14/	_9	Г	Cont	ainer No.
	Filter:			_g			
	Thimble:			_ ⁹	<u> </u>		
	Total:			9			
C. Gross Date	Weights 9/23/06 9/25/00	(1) (2) (3)	115.91 115.9	8 <u>)</u> 189	Date - -		(4) (5) (6)
				Final Gro Tare Wei Residue \ Blank We	ght: Veight:		182 141 5041 0008
D. Net V	Veights: Remarks:						U
					Analyst	JB	/vo

.ab No.	1420097 196995 WUNK AF-N-LMF119-1-M2 Sampled: 13-SE Received: 19-SE	002-125FD2	Weston, Inc 000-FHA, FIL	Tuge 24-SED	: -ocelved IS I:	9	120100 9/26100	
Description	·				Org	ann Fr	atter	
A. Sampl	e Volume	w	ash			26 mls 150 mls	Blank Correction	
Total:		r	nl× _		g/r	nl		_8
B. Tare	Weights Continer: Filter: Thimble: Total:	01.58		g g		Contai	ner No.	
C. Gros Date	9 25 66 9 25 66 9 25 66	(1) (2) (3)	101.590	Final Gross \ Tare Weight Residue We Blank Weigh			\$7	
D. Net	Weights: Remarks:				Analyst		Võ	
	*					JB /		

Lab No.: Client:		196995 9-1-M202 13-SEP-0 19-SEP-0	Roy F. Weston, -12SEP2000-FHA, 0 :0 14:35	Inc. Due: 26-SEP-09 FILT #632, BHC, BHS l	ived .	9/21	126/00	1500)
Description					probe	acotor	<u> </u>	
A. Sample	Volume		wash	8.9 2	5	_mls _mls	Blank Correction	n
Total:	110) 	ml×	3×10-4	g/m1 -	0	003	_g
B. Tare W	leights 	10	8.6822	g		Container	No.	٦
		10		g		Container	140.	
	Filler.			g				
	Thimble: Total:			9				
C. Gross Date		42	108,684	Date		(4) — (5) — (6)		_ _ _
D. Net V	Veights:	<u> </u>		Final Gross Weig Tare Weight: Residue Weight: Blank Weight:	ht: 10	8-6839 8-6832 -0017 -003	1 9	a a a a
	Remark	s:						
ı				Analy	'si <u>J</u> M	D / V	1	

Lab No.: Client:	. 1420097 — WUNK AF-N-LM Sampl — Receive	196995 IF119-1-M20 ed: 13-SEP ed: 19-SEP	Roy F. Wes 2-125EP2000- -00 : -00 14:35	ton, Inc. Due: 26-S FHA, FILT #632, BHC,	EP-0rd BHS	9/21	100	- _USO -
Description				J-	zilter-1	2		·
A. Sampl	e Volume		wash			mls mls	Blank Correcti	on
Total:			_ml ×		g/ml -			g
B. Tare V	Continer: Filter: Thimble: Total:	0.26	136	.g _g _g		Container	No.	
C. Gross Date	9/22/00 9/35/00 	(1) (2) (3) - 0 · 6	0.199° 0.1497 01639	Date 7 Final Gross Weight Tare Weight: Residue Weight: Blank Weight:	nt:	(4) (5) (6)		
D. Net W	leights: Remarks:			Analys	TMI	Ju	8	

_ab No.	1420098 19699	5 Roy F. Weston, In	D No.;	9/20/	00
Client:	WUNK AF-N-LMF119-2-M Sampled: 13-SI Received: 19-SE	1202-12SEP2000-FHA, FI EP-00 : P-00 14:35	Due: 26-SEP-0'celved LT #631, BHC, BHS .d:	, <u> </u>	4/00
Description	·		020	Inoganic	Fronto
A. Sampl	e Volume	wash		4 <u>50</u> mls	tank correction
Total:	45		2×10-4 g		909 g
B. Tare \	Weights Continer: Filter: Thimble: Total:		g g g	Container No	
C. Gross Date	9/23/00 9/25/02	(1) 117,1780 (2) 1 <u>171787</u> (3)	Date Final Gross Weight: Tare Weight: Residue Weight:	(4) (5) (6) 117-1780 117-1748	
D. Net	Weights: Remarks:		Blank Weight:	. 060 3	g
			Analyst	JB / VO	

1 - h 110 +				Pro.	No.:		
Lab No.:	1420098 1969	195 Roy	F. Weston,		ecelve	1	1/20/00
Client:	WUNK AF-N-LMF119-2- Sampled: 13- Received: 19-5	-M202-129 SEP-00 SEP-00 1	EP2000-FHA, 4:35	Due: 26-SE FILT #631, BHC, I	P-0		9/26/00
Descriptio	n				Org	anie Fri	ullor
A. Samp	le Volume					60 mls	
			_wash			150 mls	Blank Correction
Total:	21	0	_ml ×		g/	ml	9
B. Tare	Weights		-				**
	Continer:	104.	7/18	g	[Contain	er No.
	Filter:			g		Comen	
	Thimble:			g			
	Total:			⁹			
	: Weights			Da	ale	,	
Date	9/25/00	(1) (2) (3)	104.71	34	· -	(4	5)
				Final Gross V	Neight:	104.713	9
				Tare Weight: Residue Wei Blank Weigh	ight:	j04.7// . 00	12
D. Net V	Veights: Remarks:						
				. A	nalyst -	JB /	Võ

_ab No.: _ Client: _	_ 1420098 WUNK AF-N-LMF Sampled Received	•	Roy F. Westo 12SEP2000-FH		Due: 26-SEP- #631, BHC, BH	ořd 45 1	9/21/	00 1120
Description					prob	× 0.00	tire	
A. Sample	e Volume		vash		17	5 .	mls . mls	Blank Correction
Total:	200)	ml× _	3 XI	10-4	g/ml -	. 0	0066 d
B. Tare V		107.1	927 9	1				
	-	10 1.1	101	_			Container I	No.
	Filter:			g				
	Total:			g				
C. Gross Date	9/22/05 9/23/06	(1) (2) (3)	107.195	52 ST	Dale		(4) (5) (6)	
D. Net V				Tare W	Weight:	<u>16</u> <u>10</u>	7.1957 7-1927 .0025. .0004 .0019	
	Remarks:							
				•	Analyst	_Jw	15 /V	ά

Lab No.: Client:	— 14200' 		Roy F. We 02-12SEP2000 -00 : -00 14:35	ston, Inc. Due: 26- -FHA, FILT #631, BHC	SEP-OI , BHS	9/21/9	27/00 USQ
Description	n .				File	(-63]	
A. Sampl	e Volume					mls	
			wash			mls	Blank Correction
Total:	<u> </u>		_ml x		g/ml -		9
B. Tare V	Veights			-			
	Continer:			_9		Container	No.
	Filter:	0.00	183	_ 9			
	Thimble:			_9	<u> </u>		
	Total:			_ 9	•		
C. Gross Date	Weights 9127/00 1125/00	(1) (2) (3)	0.197	Dale J		(4) (5) (6)	
	-	-	4448	Final Gross Weight Tare Weight: Residue Weight: Blank Weight:			
D. Net W	Veighls: Remarks	:					
				Analys	st	n /v)

MUNK AF-N-LMF1 Sampled: Received:	19-3-M202-1 13-SEP-00 19-SEP-00	Roy F. Weston, Inc. 2SEP2000-FILT #630 14:35	Pro. No.: Date Rece Je: 26-SEP-0 Date Out:		9/21 9, 030	00 (150 127/a
A. Sample	Volume	wash			mls mls	Blank Correction
Total:		ml ×		_g/ml -		g
B. Tare W. C. Gross Date D. Net W.	Continer: Filter: Thimble: Total: Weights 9/122/00	 0.00240g	g g g g Date Final Gross Weigh Tare Weight: Residue Weight: Blank Weight:		(4) (5) (6)	g
			Analys	1 TM	0/4	

Lab N	•	995 Roy F. Weston, I	nc. Due: 26-SEP-Qecel	wod	9/20/00
Client	WUNK COMP: AF-N-LMI Sampled: 13- Received: 19-	-119-1-3-M202-12SEP200 SEP-00 : SEP-00 14:35	0-FILT #630, 631, (9/27/00
Descripli	on _		Filt	ic #632	-631-630
A. Samp	ple Volume	·		mls	•
		wash		mls	Blank Correction
Total:		ml ×		g/ml	g
B. Tare	Weights				
	Continer:	0.20136	_g	Cont	ainer No.
	Filler:	6.20183		Com	ainer No.
	Thimble:	0.20432	_g		
	Total:	0.60751	_9		
C. Gros Dale	ss Weights		Date <u>243</u> 31		(4) (5) (6)
	-	0.00850	Final Gross Weight: Tare Weight: Residue Weight: Blank Weight:		
D. Net	Weights: Remarks:				
			Analyst	JH /	vs

6	Due: 10-0CT-0		16/2/00	VO
28-SEP-00 16:00 Description:	F.1	Date Out: $\frac{4}{5}$	6	
A. Sample Volume:	· · · · · · · · · · · · · · · · · · ·	_mls		Was
			Blank C	orrecti
Total:	ml x	g/ml		g
B. Tare Weights:			•	
Container:		_g		
Filter:	7.20166	_g		
Thimble:		_g	•	
Total:		_9		
C. Gross Weights:		Before		
Date 9/29/00	(1) 0.2033 (2) 0.2011	Dat	e 10/2/0° (3)	<u>0. J</u>
10/2/00	(2) 0.2011	+7 pm	(4)	
0.000	0.20166			
0.0070	. 30147	Final Gross We	ights: 0	g
+ .00065 Defoi Dyy	after	Tare Weight:		g
0	Brygny	Residue Weigh	t:	g
		Blank Weight:		_ g
		Residue Weigh	t:	_ g
D. Net Weights: Remarks:				

	Lab No:	Pro. No:	_
1421166	196995 Roy F. Weston, Inc.	Date Received: 912100 (<u>5</u> 10)
WUNK Filter W Sampled	N647	Date Out: 10/3/00	VO
Receive	d: 28-SEP-00 16:00		_
	Description:	Filter # 647	
	A. Sample Volume:	_mls	_Wash(mls)
		Blank Co	rrection
	Total:ml x	g/ml	g
	B. Tare Weights:		
	Container:	_9	
	Filter: 0.20071	_9 ~	
	Thimble:	_9	
•	Total:	_g	
	C. Gross Weights:	1.0	
	Date <u>9/29/0</u> 0 (1) <u>0.201</u>	30 Date 10/0/00 (3)	0.20065
	Date $\frac{9/29/00}{10/200}$ (1) $\frac{0.201}{0.200}$	060 ATE (4)	
ر ،	12001		
	00059 9 - 000119	Final Gross Weights:	g
Be	ford after	Tare Weight:	g
1) ^	Diring	Residue Weight:	g
		Blank Weight :	g
		Residue Weight:	g
	D. Net Weights: Remarks:		

1421167	196995 Ro	y F. Weston,	Inc.	Pro. No:		
WUNK Filter W6		:	Due: 29-SEP-0 1 Bottle 50A of 00	Date Received:	100/00	_VO _VO
	Descriptio	n:	· <i>F</i>	Filter # 65	/8	
	A. Sample	Volume:		_mls		Wash(mls)
				•	Blank Co	orrection
	Total:		ml x	g/ml		_ g
	B. Tare We	eights:	· .			
		Container	:	g		
		Filter:	0.20092	_g_		
		Thimble:		_g	•	
		Total:		_g		
	C. Gross V	_		las	•	
	Date	9/29/6	a (1) <u>0.201</u>	150 077 Date	10/2/00 (3)	020074
	;	10/2/00	(2) 0.300	078 MM	(4)	
1	20150		120092	y		
	20092		1, 20074	Final Gross Weig	ghts:	_ g
+ 6	.00058 Dayy) <u> </u>	100018 aftr	Tare Weight:		_ g
·	DMY		Oigy	Residue Weight:		. g
				Blank Weight :		. g
				Residue Weight:		g
	D. Net Wei	ghts: Remarks:		Para de la companya d		
						,